U. S. DEPARTMENT OF AGRICULTURE

STATES RELATIONS SERVICE

A. C. TRUE, DIRECTOR

EXPERIMENT STATION RECORD

VOLUME XXXV

JULY–DECEMBER, 1916

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EXPERIMENT STATION RECORD.

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[1] Printed in scientific and technical publications outside the Department.

U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
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[a] Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

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Some of our strongest impressions are gathered from seeing with our own eyes and experiencing by contact the things going on about us. It is so with the progress of the experiment stations. We may read about it in their reports and hear about it at meetings, but only through coming into contact with these institutions in their local environment can an adequate idea be had of their scope, variety, and vital place in the community, as well as the actual conditions under which they are working.

Such an opportunity for study is given by the annual visitation of the stations, made by representatives of this Office. And as several years usually elapse between the visits of the same individual, the chance is offered for measuring the growth and comparing the general situation. Taking account of any obstacles in the local situation as well as of the favorable conditions, the sympathetic if critical examination on such occasions seeks out the good quite as much as the weak, and in this attitude endeavors to gain a true perspective. It is a most interesting and stimulating experience—more so as the development goes on. In no other way can a fair understanding and a just appreciation of the stations be acquired.

A recent tour of a section of the South and West has given opportunity to come again into intimate contact and association with the stations in that region, and to see them at work in their own particular fields. The trip suggests some thoughts and impressions which, while not necessarily confined to that section, apply particularly to the stations there. Although they naturally present many and often wide differences, taken as a whole they are typical of the progress and the spirit of the present stage.

No one could pretend to study the work of an experiment station in a visit of two or three days, but by close, appreciative attention he may gain a knowledge of the men comprising the force, get an insight into their work, catch something of the spirit and atmosphere which dominates the institution, and gather an impression of the general situation. The latter relates to the conditions without as well as within the institution—the general attitude toward the sta-

tion and its workers on the part of the public, the governing board, and the administrative officers. It reflects the encouragement and opportunity given the station, and the feeling as to the success and effectiveness of the work as a whole.

Right conditions are just as essential to success as the right kind of men, and these two essential elements can not be separated without influencing the general effectiveness. Favorable conditions are not alone a matter of funds or size of institution, or geography, or equipment, or even of being let alone. They are a matter of spirit, of leadership, of sympathetic encouragement and protection.

In these respects the situation has steadily improved and in general is most commendable—better in some places than in others, of course, but such everywhere as to make enthusiastic, ambitious workers, with confidence and pride in their station. Despite one or two disquieting evidences that tenure is not yet wholly a matter of merit, there was uniform evidence of a broader and more appreciative view and a better understanding of the requirements of station work. None of the stations visited have stood still; most of them have shown such distinct advancement as to make them unquestionably stronger, more influential, and in better condition than they have ever been before. Including as it does some of the newer country where development has been more tardy, the situation is most gratifying.

The credit for this progress rests back in large measure upon the personnel of the stations, the respect and support they have been able to command, the opportunity and protection accorded them. The men make the station, given the opportunity, and a station can not rise above the level they represent, no matter how generous the support. It is strange that this is not fully realized, for failure to appreciate it results in false economy.

No one can come into personal contact with the station workers on the field of their activity without being impressed with their zeal and industry. They are an unusually busy group of men, keen and alert, and with a zealous interest in the problems of the region which is blind to personal hardship or self-sacrifice. There is something remarkably fine in the spirit of service, of accomplishment, which ties these men to their field, particularly in the newer country where the appeal seems especially strong. It becomes a devotion; a man's life and personality seem centered in the new country and the young institution, and the advancement of these seems almost to be a personal aspiration with him.

The position of such men has been well stated by President Wilson, in a recent address in which he characterized the motives of men engaged in scientific work. He said: "There is something very intensely appealing to the imagination in the intellectual ardor which

men bestow upon scientific inquiry. No social advantage can be gained by it. No pecuniary advantage can be gained by it. In most cases no personal distinction can be gained by it. It is one of the few pursuits in life which gets all its momentum from pure intellectual ardor, from a love of finding out what the truth is, regardless of all human circumstances—as if the mind wished to put itself into intimate communication with the mind of the Almighty itself. There is something in scientific inquiry which is eminently spiritual in its nature. It is the spirit of man wishing to square himself accurately with his environment, not only, but also wishing to get at the intimate interpretations of his relationship to his environment. . . .

"So when I stand in the presence of scientific men I seem to stand in the presence of those who are given the privilege, the singular privilege, the almost contradictory privilege, of following a vision of the mind with open, physical eyes; making real the things that have been conjectural; making substantial the things that have been intangible."

This is singularly applicable to those engaged in the various forms of agricultural work. Nowhere does the vision seem to be more aluring or the opportunity greater to "make real the things that have been conjectural" and to put this knowledge into tangible, living form. The possibilities and the desire for help stimulate the responsive workers to unusual activity and effort. Everywhere these men are found to be carrying a heavy load of teaching in the college, with increasing requirements from regular and graduate students, and subject to almost constant appeals for assistance of a kind which they can not turn over to the extension departments. Despite the more general differentiation and specialization of duties, the station men especially often find themselves loaded with more work than they can prosecute as they would like to, and are led by their enthusiasm to work under unusually high pressure. When a man carrying sixteen hours a week of teaching throughout the year voluntarily conducts an active line of station investigation, often involving personal hardship in the making of trips, no doubt can remain of his zeal and his determination not to be deterred by circumstances.

One wonders whether there is another branch of investigation where the problems press so hard and the eagerness for help makes so strong an appeal to the very best there is in men. The field is so inspiring and stimulating, and gives such a vital opportunity for direct service that the men need often to be guarded against overwork or the tendency to lay out more than can be wisely undertaken. In such cases the workers need protection from themselves and their friends, for they can not be constantly turned from their investigations, and they must recognize the limitations to their time and strength.

The station workers sometimes need protection in another direction, namely, against unfair critics and unknowing or self-seeking factions. These are far less common than formerly but they still have to be reckoned with. Such a hostile attitude is sometimes directed against the station as an organization but more often against an individual member, especially the director. Upon these administrative officers the burden rests heavily. A variety of responsibilities are entrusted to them. The various sections and interests of a large State have to be considered, and often are in competition. Suggestion and argument sometimes proceed to the point of attempted dictation. Activity in the latter direction by organizations in a number of States constitutes a new menace. In such cases the governing board can prove a tower of strength to the administrative officers and can protect the station from being stampeded or subjected to domination.

Station directors, being human, make mistakes, but usually their errors are errors of judgment rather than violations of principle. They are honest, and they have the success of their work at stake. Their interest in the welfare of the institution usually far transcends that of private individuals or organizations who are attempting to rule and threatening as an alternative to ruin. To cast lightly aside a director or take away his power because of attack upon him is to deprive the station of the main support it has a right to expect from the governing board, and to encourage a condition which will make successful administration a difficult matter.

Fortunately, the position of director has been almost entirely divorced from politics and from personal influence, and has usually been based on merit and ability alone. The good a successful director does and the results he accomplishes far transcend his occasional mistakes, and his case deserves to be considered squarely on its merits, having in mind his record for constructive work and his value to the State.

The increase in physical equipment and in financial support of the stations in this western section makes a deep impression on the casual visitor. The crude conditions of a few years ago have given way to substantial provision in accord with the present needs. It is an evidence of the acceptance of the station as a necessary agency for safe progress, and of a willingness to meet its real requirements. On every hand there are signs of this, and of the fact that the people are not only in a receptive mood and ready to follow the advice of the stations, but that they are leaning upon them for guidance—in the development of such humble branches as goat farming as well as in matters pertaining to the highly developed citrus industry.

We find, for example, in Texas a system of eleven state stations, to study the problems of particular regions and special industries or

types of farming, closely correlated with a strong central station at the college. This system is supported by a lump sum appropriation of $135,000 annually, together with proceeds from sales amounting to upwards of ten thousand more. This shows a liberality and confidence quite out of harmony with the present tendency in some States to tie up the appropriations to specified expenditures and lines of work, and to take away from the station any incidental revenue derived from sales or fees.

The New Mexico Station is encouraged and heartened by its first state appropriation for support, which although small is of material assistance. One of its special features of equipment is a spacious outdoor laboratory for studying the duty of water in agriculture, hardly equaled anywhere. The facilities offered in Arizona are excellent and would be a surprise to one visiting the station for the first time. Among notable additions are a splendid new agricultural building, a pride to any State and an ornament to any campus, and a new farm of 160 acres to better meet the needs of field work in the Salt River Valley.

We have learned to expect large things of California, but the extent to which it is meeting the needs of its varied agriculture, from the tropical region of the Imperial Valley to the northernmost part of the State, leaves no doubt of the place the station work has made for itself in that State. A citrus station is being developed in the southern end which will be unequaled in the world, with opportunity for investigation and advanced study over the whole range of subtropical agriculture. The new tract of 475 acres at Riverside, recently purchased for this station at a cost of $55,000, is now being made ready, and the plans have been approved for buildings to be erected with a $125,000 appropriation. At Berkeley a $360,000 addition to the large agricultural building erected a few years ago is planned for, to relieve the crowded condition of nearly all the agricultural departments.

Elsewhere the progress is hardly less noticeable, if not on as large a scale. Missouri and Kansas some time ago provided their complement of buildings for agriculture, and are constantly increasing the special facilities in the way of equipment and apparatus. Minor changes are also developing in other States to meet the needs of particular lines of investigation, such as the veterinary work in Nevada, the poultry work in Utah, etc. Few stations, irrespective of size, have more adequate equipment for investigation in chemistry and meteorology than in Nevada, and the special provision made in Missouri and Kansas for studies in the use of feed by growing animals is widely known.

It is worthy of note that not a single station in the region visited fails to receive some state appropriation for its maintenance, and frequently the amount is very large. This, it is to be remembered, is in a relatively new section in much of which cultivated agriculture is only partially developed as yet, and where only a few years ago the need for the work of an experiment station was but slightly felt. The eight stations in the section in question are this year devoting a total of considerably more than three-quarters of a million dollars to their work, aside from appropriations for new building—a worthy example for some of the States farther East.

It is highly gratifying, furthermore, to find the names of the pioneers in agricultural service immortalized in the buildings erected for agriculture, often as stately and imposing as any on the campus, and worthy memorials to those who laid the foundations for the present great development. It shows that at heart the people are grateful. Confidence in this fact is surely one of the rewards of service, even if evidence of it is sometimes delayed.

But more remarkable even than physical equipment or than the generous financial support is the impression which the work itself makes upon the visitor in going from station to station. The extent of it and the great range and variety of it are well-nigh bewildering—from such unusual subjects as the ostrich and the date and the cactus in Arizona, the citrus, avocado, and wine and raisin grapes in California, the range problem in Nevada, the alkali and irrigation studies of other sections, and the problems of dry farming, to the more familiar ones of grain and stock farming in the humid sections.

Many of the broad general subjects are of course similar all over the country, and fall into certain rather definite classes, but the infinite variations given to common topics in different places by reason of the special conditions of the sections illustrate, as almost nothing else does, the enormous variation in environment and the necessarily local character of many lines of inquiry. It shows that natural laws must be very broad to cover such a range of differences, and that facts and principles assumed to have been established are more restricted than supposed and often require local adaptation.

These things make the work not only varied but highly specialized. Fighting drought in one section, overcoming it with irrigation in others, and avoiding the effects of too much water elsewhere—each brings its own special group of problems to tax the knowledge and the ingenuity of the most versatile investigator. The difference in the behavior of the same kind of soil in California and in Kansas, and the variation in the life history of insects and organisms causing diseases in sections having different climate and season, contribute to the almost endless variation in plan and method as well

as in results. A scale in southern California apparently withstands heavier doses of poisonous gas than the same species elsewhere, a type of cultivation is found adapted in one section and inadvisable in another, peculiar effects of soil on the crop are unmistakable in some places and absent in others—no wonder there are conflicting reports, differences of opinion, and controversy. The accumulation of these facts teaches both caution in too wide application of the findings and tolerance of the views and results of others. Both parties may be right when the whole truth is known.

Whether the work deals with practical economic experiments in the culture of plants and the feeding of animals, the study of the principles of breeding them, the activities of the lesser forms of life that inhabit the soil, or the ravages of an insect or a plant disease, the final aim is control—dominion over the soil, the growing things, the elements; and where control and dominance are not feasible, the effort is no less direct to avoid or overcome the obstacles by adaptation or by finding some means of getting around them.

Everywhere the aim is to understand, to dominate and control through knowledge, to make intelligence take the place of blind force in fighting against the effects of adverse conditions and circumstances. And above all, to replace tradition with reliable information, and to establish in these early and prosperous days a basis of knowledge and intelligence which will prevent the coming of those hard conditions which result from worn-out soil and abusive practice.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Practical organic and biochemistry, R. H. A. Plimmer (*London and New York: Longmans, Green & Co., 1915, pp. XII+635, pl. 1, figs. 86*).—This is a practical laboratory guide of organic chemistry in its relation to biochemistry. The scope of the volume has been extended over that of the author's earlier work, new sections on organic chemistry and organic substances found in plants having been added.

A list of standard and special reagents is appended.

The world of neglected dimensions, W. Ostwald (*Die Welt der Vernachlässigten Dimensionen. Dresden: Theodor Steinkopff, 1915, pp. X+219, pls. 6, figs. 33*).—This volume is the outcome of a series of lectures on colloid chemistry delivered during the winter of 1913–14 in the United States and Canada. The subjects discussed are (1) the fundamental phenomena of the colloid condition, colloids as disperse systems, and the methods of preparing colloidal solutions; (2) colloidal systems; (3) changes in colloid condition; (4) the scientific application of colloid chemistry; and (5) the technical and practical application of colloid chemistry. An appendix and a complete subject index are included.

Annual reports on the progress of chemistry for 1913–14, edited by J. C. Cain and A. J. Greenaway (*Ann. Rpts. Prog. Chem. [London], 10 (1913), pp. IX+300, fig. 1; 11 (1914), pp. VIII+303, figs. 9*).—These reports deal with the progress in general, physical, inorganic, organic, analytical, physiological, agricultural, and mineralogical chemistry, vegetable physiology, and radioactivity.

Report of the agricultural chemist, J. C. Brunnich (*Ann. Rpt. Dept. Agr. and Stock [Queensland], 1914–15, pp. 30–61*).—This report contains a general review of the routine and investigational work carried on during the year 1914–15.

The results of the soil, water, seed, wheat, and flour analyses are recorded in tabular form, those of soils being also noted on page 20 of this issue.

On the isolation and properties of tethelin, the growth-controlling principle of the anterior lobe of the pituitary body, T. B. Robertson (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 409–421, pl. 1*).—The substance which appears to be the growth-controlling principle in the anterior lobe of the pituitary body was isolated by extraction with boiling alcohol, concentrating under reduced pressure to incipient separation of solid material, and then precipitating by anhydrous ether. The precipitate thus formed was washed several times with a mixture of absolute alcohol and anhydrous ether and finally dried over sulphuric acid at a temperature of about 30 to 35° C.

The material is soluble in water, ethyl alcohol, ethyl ether, chloroform, and carbon tetrachlorid, but insoluble in an alcohol-ether mixture (1:1.5). It contains 1.4 per cent of phosphorus, and 2.58 per cent of nitrogen as determined by the Kjeldahl-Gunning-Arnold method. The P:N ratio is thus approximately 1:4, two nitrogen atoms of which are present as amino groups and a third as an

imino group, which on hydrolysis with barium hydroxid is converted to an amino group, as shown by an increase in the amino nitrogen content. From the products produced by hydrolysis with barium hydroxid several fractions were isolated, from one of which *d-l*-inosite was obtained.

In aqueous solution the substance does not yield the biuret reaction or reduce Fehling's solution. Qualitative tests indicate the presence of an iminazolyl group, and in this respect it seems to be related to the physiologically active principles of the posterior lobe of the pituitary, but it does not possess the characteristic properties of these substances, viz, the production of a rise in the blood pressure, stimulation of smooth muscles, and diuresis.

A new method for the preparation of the plant globulins, G. Reeves (*Biochem. Jour., 9 (1915), No. 4, pp. 508–510*).—The author describes a new procedure in which the proteins are obtained by extraction with a half-normal solution of sodium benzoate and precipitated from this extract by dilution with water. The amorphous material thus obtained can be obtained in the crystalline form in the usual manner of recrystallization from salt solution. Edestin from hemp seed, excelsin from the Brazil nut, and a mixture of legumin and vicillin from horse beans were thus prepared. Sodium salicylate was also tried as a solvent but was found to be unsuitable.

Notes on some fatty and essential oils, S. Higuchi (*Extracts from Bul. Forest Expt. Sta., Tokyo, 1915, pp. 81–88*).—The author reports the physical and chemical constants of various oils obtained from seeds and woods indigenous to Japan. The value and use of the various oils are indicated.

Recent advances relating to the composition and analysis of edible oils and fats, E. R. Bolton and C. Revis (*Analyst, 40 (1915), No. 477, pp. 494–503*).—This communication reviews in general the advances made in the subject of edible oils and fats during the past few years. The original references to the work are cited and briefly discussed.

Tobacco seed oil, N. H. Cohen (*Indische Mercuur, 38 (1915), No. 43, pp. 884, 885; abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 2, p. 126*).—The oil obtained from the tobacco seed was found to be a rapid-drying oil and an excellent substitute for linseed oil. About 14.4 per cent of oil was obtained from the seed. The press cake was found to contain about 0.8 per cent of potassium, 1.15 per cent of phosphoric acid, and 4.2 per cent of nitrogen, as compared with 2.06 per cent of potassium, 1.5 per cent of phosphoric acid, and 4.2 per cent of nitrogen in the seeds.

Stearins occurring in fats and their behavior during hydrogenation, J. Marcusson and G. Meyerheim (*Mitt. K. Materialprüfungsamt Gross-Lichterfelde West, 33 (1915), No. 3–4, pp. 221–226*).—Experimental data demonstrating that during the hydrogenation of fats the stearins are not attacked or changed in any way are submitted. These results are in accord with those reported by Bömer (E. S. R., 28, p. 616).

Some important fermentations in silage, O. W. Hunter and L. D. Bushnell (*Kansas Sta. Tech. Bul. 2 (1916), pp. 5–32*).—This bulletin reports the results of a detailed study of the ripening changes occurring in silage. The results of the quantitative estimation of the total number of organisms in 1 cc. of a physiological salt solution extract and of the number of liquefiers, acid producers, Bulgarian group, yeasts, and colon group in Kafir corn, cane-fodder, and alfalfa silage are reported in tabular form. Chemical analyses relative to the moisture, total acidity, total volatile acidity, and total nonvolatile acidity, together with the surface and center temperatures of the silo, are also reported.

The effect of antiseptics on silage fermentation was also studied. Antiseptics were found to inhibit markedly the growth of the principal types of the microorganisms and consequently cause a marked decrease in the final total acidity.

It is indicated that in general the greater part of silage fermentation is due to the activity of micro-organisms consisting of four prominent groups, (1) the acid group, (2) the colon group, (3) yeasts, and (4) a miscellaneous type. The most important fermentation is that of acid production which is largely due to a group of organisms belonging to the Bulgarian group.

The morphology and the cultural and biochemical features of the Bulgarian group organisms are described in detail.

On the urease of the soy bean and its "coenzym," N. Onodera (*Biochem. Jour., 9 (1915), No. 4, pp. 575–590*).—It has been shown that "the urease of soy bean loses its activity on dialysis. The lost activity is restored by the addition of a small amount of fresh urease. This indicates that the fresh urease contains coenzym. The coenzym could not be separated, accordingly its nature is not yet known. It is very likely that the coenzym is a system consisting of two groups of components, one of which is dialyzable and the other undialyzable. The dialyzable component undergoes some irreversible change during dialysis.

"The coenzym consists of two parts, fixed and free. Heating and dialysis destroy the free coenzym first, then the fixed coenzym. The last portion of the fixed coenzym is found in the precipitate produced by dialysis, resisting the influence of heating and dialysis tenaciously. The inhibitory effects of heat, acid, and alkali are exerted upon the coenzym, but not upon the urease proper. In germination urease accumulates in the germs of the soy beans in large proportion, but free coenzym is absent. Although ox serum has an accelerating power, it contains no substance which can be compared with the coenzym."

On the effects of various substances (electrolytes, nonelectrolytes, alkaloids, etc.) upon the urease of soy bean, N. Onodera (*Biochem. Jour., 9 (1915), No. 4, pp. 544–574, figs. 2*).—The experimental data demonstrate that in the inhibitory effects of inorganic and organic acids on urease the hydrogen ion concentration plays a very important rôle, but does not coincide with this in the inhibitory effects of caustic soda and ammonia. The inhibitory effect of soda can be ascribed to the hydroxyl ion concentration, but ammonia has some further action. Methyl, ethyl, and propyl alcohol in 1-molar solutions and amyl alcohol in $\frac{1}{40}$-molar solution accelerate the urease action, but stronger solutions retard the action. Aldehyde inhibits urease notably. The effect of neutral salts is due to their metallic bases. Tenth-normal solutions retard urease action because metallic bases displaced by the ammonia produce a greater hydroxyl ion concentration than the equivalent of ammonia. Alkaloid salts accelerate the action in the the first stage of hydrolysis. The bases, however, markedly inhibit the action.

Factors influencing catalase in milk, H. M. Höyberg (*Ztschr. Fleisch. u. Milchhyg., 26 (1915), Nos. 5, pp. 70–74; 6, pp. 85–88; 26 (1916), No. 7, pp. 104–106*).—The author concludes that the catalase activity of milk and serum is dependent on the protein, probably the albumin. Serum and milk can possess catalase properties in the absence of bacteria, cell elements, and fibrin. The catalase activity did not change in milk which has stood for 10 hours at 15° C. (59° F.), and in some cases an increase was evident. The activity was increased in many cases by heating to 45°, and at 68° the catalase is destroyed. Changes in the reaction of the milk do not affect the catalase, which is apparently contrary to the enzym theory of action.

Notes on the catalase reaction of milk, H. B. Taylor (*Jour. and Proc. Roy. Soc. N. S. Wales, 48 (1914), No. 3, pp. 319–332*).—In the course of an investigation on the physico-chemical constants of milk the author has observed that the velocity constant in the catalase reaction varies considerably in different

samples. This variation may be accounted for by the production of the catalase by bacteria in the milk while still in the udder, or later by bacteria from the air.

The rate of destruction of milk catalase is greatly increased by the rise of temperature. Potassium cyanid and hydrogen cyanid, although decreasing the activity of the enzym, have the effect of causing the enzym to decompose a greater amount of hydrogen peroxid. It is concluded that "there appears to be no doubt that the catalase of milk is analogous to the catalase obtained from blood."

The persistence of hydrogen peroxid in milk, E. HINKS (*Analyst, 40 (1915), No. 477, pp. 482–491*).—The length of time during which varying concentrations of hydrogen peroxid persist in both fresh and old milk and the influence of temperature on its persistence was studied.

It was found that hydrogen peroxid is at first rapidly destroyed but that the rate of destruction gradually diminishes. If the concentration of peroxid is high enough to withstand the rapid initial destruction the residual peroxid remains fairly constant over long periods of time. Fresh milk destroys hydrogen peroxid less readily than 3-day-old milk. The effect of a rise in temperature was to lengthen the time during which peroxid persisted, but the initial destruction was found to be greater at the elevated temperature. It is concluded that the ultimate result must be due to the combined destructive effect of the catalase on the peroxid and of the peroxid on the catalase.

Of the reagents used for the peroxidase reactions paraphenylenediamin was found to be the most generally applicable. On account of the destruction of peroxidase by peroxid it is necessary when testing for the latter to add some fresh milk to the sample in order to insure the presence of peroxidase. In applying the peroxidase reactions for the detection of previous heating the possibility of the milk having received an addition of peroxid must be considered, for a milk containing peroxid and a heated milk will, under certain circumstances, react in exactly the same manner.

Commercial and industrial analysis (organic), G. HALPHEN and C. QUILLARD (*La Practique des Essais Commerciaux et Industriels; Matières Organiques. Paris: J. B. Baillière & Sons, 1915, 3. ed., rev. and enl., pp. VII+349, figs. 79*).—This volume outlines in detail procedures for the examination and analysis of amylaceous materials, spices, sugar materials and products, liqueurs and other fermented beverages, milk, cheese, edible oils, waxes, resins, caoutchouc, mineral oils, fuel, coal-tar products, fats, paper, textiles, tanning materials and leather. The microscopical as well as the chemical analysis is considered.

Boiling and condensing points of alcohol-water mixtures, P. N. EVANS (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 260–262, fig. 1*).—The relation between the boiling point (or condensing point) and the composition of both the liquid and vapor phases of various mixtures of alcohol and water has been determined. These data are presented in tabular form and are of value in determining the quantity of alcohol present in an unknown mixture from its boiling point. The accuracy of the results by this procedure is necessarily less than by the more difficult method of distillation and the determination of the specific gravity of the distillate with a pycnometer.

The electrolytic determination of iodin present in organic matter, R. B. KRAUSS (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 321–325*).—In the proposed method, which is described in detail, palladium is first deposited from an ammoniacal solution of palladous iodid on a platinum cathode, and the iodin subsequently on a silver anode. The new procedure provides an adequate check on a series of determinations by the palladous iodid colorimetric method, previously described by the author (E. S. R., 34, p. 504), but is far less sensitive.

A proposed new method for citrate-insoluble phosphoric acid, C. H. Hunt (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 251–253*).—Confirming the findings of previous investigators, the author has shown that lime, limestone, and other calcium compounds increase the citrate-insoluble phosphoric acid. The ratio between the lime, determined as such, and the citrate-insoluble phosphoric acid has been shown to be fairly constant.

"In the proposed method the fertilizer is digested as for total phosphoric acid. An aliquot is made alkaline with ammonia and the phosphoric acid is determined in the precipitate thus formed. The ratio between the citrate-insoluble phosphoric acid and the phosphoric acid precipitated with ammonia is about 1 : 1.5. By dividing the amount of phosphoric acid precipitated with ammonia by 1.5 we obtain a figure which is approximately equal to the citrate-insoluble phosphoric acid determined by the official method. The plus and minus errors in the final results nearly balance each other.

"The fact that the errors for bone meal are nearly the same, and that for tankage and complete fertilizers are also nearly the same but of opposite quantity, seems to suggest a possibility of using a different factor for different types of fertilizers. The difference between the results obtained by the official and proposed methods is no greater than the differences in the results obtained by different analysts working on the same sample when the official method is used. The proposed method claims to be much shorter and less expensive, doing away with the use and preparation of neutral ammonium citrate."

The determination of citric-acid-soluble phosphoric acid in Thomas slag by the iron-citrate method, Celichowski and F. Pilz (*Ztschr. Landw. Versuchsw. Österr., 18 (1915), No. 10, pp. 581–591*).—It has been shown that in the preparation of the iron-citrate solution a clear, fresh solution of iron chlorid can be used. Old solutions which are partly decomposed and contain colloidal iron oxid are to be avoided. The iron-citrate solution used in the determination must not be too old, as it may influence the results due to partial dissociation. The hydrogen-peroxid solution should be comparatively fresh and controlled by testing from time to time. In the determination the reagents should be added to the citric acid extract in the following order: Iron-citrate solution, hydrogen peroxid, and magnesium mixture. To insure a rapid separation of the magnesium precipitate the solution should be strongly agitated.

The determination of potassium in fertilizers, F. Pilz (*Ztschr. Landw. Versuchsw. Österr., 18 (1915), No. 4–5, pp. 77–108.*)—From preliminary experiments the author has developed a method for the determination of potassium in separate (potassium chlorid, kainit, kieserite, etc.) and mixed potassium fertilizers (potassium superphosphate, wood ashes, etc.) similar to the perchlorate method. The procedure is described in detail and tables for the conversion of $KClO_4$ into K_2O appended.

Note on the estimation of fat in food for infants, H. G. Chapman (*Jour. and Proc. Roy. Soc. N. S. Wales, 48 (1914), No. 3, pp. 469–472*).—Certain discrepancies in the estimation of fat in infant foods by different procedures are reported.

The analysis of maple products.—VI, A volumetric lead subacetate test for purity of maple sirup, J. F. Snell, N. C. MacFarlane, and G. J. Van Zoeren (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 241–243, fig. 1*).—The volumetric lead subacetate method proposed by the authors consists in diluting the sirup to 10 times its original volume and titrating with a standard subacetate solution, the end point being measured by electrical resistance. The volumetric lead number is then the abscissa of the point of intersection of two straight lines on the plot, with volumes as abscissæ and resistances as ordinates. It is concluded that if future work corroborates the past experience

of the reliability of the method the test will prove the most useful single test for the purity of maple products yet proposed.

Experimental data obtained by the proposed volumetric lead method and by the Canadian lead number method from 20 samples are submitted.

The determination of cholesterol in blood, W. R. Bloor (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 227–231*).—The author describes a quantitative colorimetric procedure for the determination of cholesterol, based on the Liebermann-Burchard color reaction.

The method consists of slowly adding from a pipette 3 cc. of whole blood, plasma, or serum to 75 cc. of alcohol-ether (3:1) mixture, contained in a 100 cc. graduated flask. The contents of the flask are kept in motion to avoid clumping of the precipitated material, and raised to boiling by immersion in a water bath. The flask is then cooled to room temperature, filled to the mark with the alcohol mixture, thoroughly mixed, and filtered. Ten cc. of this extract is evaporated to dryness in a small beaker, care being taken to prevent overheating, and the cholesterol extracted from the dry residue by boiling out three or four times with small portions of chloroform and decanting into a 10 cc. glass-stoppered, graduated cylinder. This solution should be colorless but not necessarily clear. To this, 2 cc. of acetic anhydrid and 0.1 cc. concentrated sulphuric acid are added, the solution well mixed, and then allowed to set in the dark for 15 minutes. The color thus produced is compared to that produced by a standard solution of cholesterol in chloroform, in a Duboscq colorimeter. The cement of the colorimeter cups must not be soluble in chloroform. Plaster of Paris or ordinary glue have been found satisfactory if the cups are not used for any other purpose.

The error of the above method is from 4 to 5 per cent. Greater accuracy may be obtained at the expense of more material and time. Experimental results obtained with the new procedure average about 20 per cent higher than those obtained by the Autenrieth-Funk method.[a]

The volumetric estimation of total sulphur and sulphates in small quantities of urine, J. C. Drummond (*Biochem. Jour., 9 (1915), No. 4, pp. 492–507*).—An improved procedure of the benzidin method of Raiziss and Dubin (E. S. R., 33, p. 415) for the determination of sulphur in urine and other biological material, in which as little as 2 cc. of sample can be used, is described. The precipitated benzidin sulphate is titrated with a $\frac{2}{100}$-normal alkali.

A method for the determination of alcohol in the presence of phenol, J. Ehrlich (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 240, 241*).—The author has observed that, in the usual method of determining ethyl alcohol in the presence of phenol by means of distillation from strongly alkaline solution, a trace of phenol resulting from the partial hydrolysis of the phenolate is always carried over in the distillate.

To obviate this source of error in the method proposed, any phenol that may be carried over in the first distillation is precipitated with bromin, the slight excess of bromin being immediately removed with normal sodium thiosulphate. The precipitated tribromphenol is dissolved as the phenolate by alkali, the mixture again distilled, and the alcohol thus determined.

If the original phenol content is low the first distillation may be omitted. If there is a great amount present two distillations are necessary, as the bulky precipitate of tribromphenol makes it impossible to perceive when an excess of bromin is present.

Experimental results submitted indicate the great accuracy of the procedure.

[a] München Med. Wchnschr., 60 (1913), No. 23, pp. 1243–1248.

A rapid pycnometric method for "gravity solids" in cane-sugar factories, H. S. Walker (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 262–264*).—A procedure using a modified pycnometer with specially constructed correction tables is described in detail. In the proposed method the average error is greatly reduced.

Theories on the formation of molasses from the standpoint of phases, T. van den Linden (*Meded. Proefstat. Java-Suikerindus., 5 (1915), Nos. 14, pp. 419–436, figs. 5; 16, pp. 447–476, figs. 10; Arch. Suikerindus. Nederland. Indië, 23 (1915), Nos. 27, pp. 1033–1050, figs. 5; 37, pp. 1389–1418, figs. 10*).—The author reports the results of his investigation of the 3-phase system, saccharose and nonsaccharose material and water, and indicates its probable application in practical sugar manufacture.

A proposed method for the profitable utilization of waste sulphite liquor, H. V. Tartar (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 226–228*).—As the result of an investigation to determine the possibility of utilizing waste sulphite liquors, conducted in an experimental distillery at the Oregon Experiment Station, a simple and easily controlled process for the economic production of alcohol from the liquor was developed. In the process the sulphite liquor is so detoxicated as to make it, when properly diluted, practically harmless to fish.

Fruit preserving: Canning, bottling, jam-making, and candying peel, W. J. Allen (*Dept. Agr. N. S. Wales, Farmers' Bul. 88, 2. ed. (1915), pp. 43, figs. 27*).—This is the second edition of the publication previously noted (E. S. R., 32, p. 509). Some new material on the canning of vegetables has been added.

METEOROLOGY.

Climatic variations and economic cycles, E. Huntington (*Geogr. Rev., 1 (1916), No. 3, pp. 192–202, figs. 4*).—This is a critical review of recent contributions to this subject, particularly those of Moore and Pettersson. It is pointed out that, from a study of the rainfall in the Ohio Valley and Illinois and its relation to the growth of corn, oats, hay, and potatoes, Moore concludes [a] that "'the weather conditions represented by the rainfall in the central part of the United States, and probably in other continental areas, pass through cycles of approximately 33 years and 8 years in duration, causing like cycles in the yield per acre of the crops. . . . The rhythm in the activity of economic life, the alternation of buoyant, purposeful expansion with aimless depression, is caused by the rhythm of the yield per acre of the crops; while the rhythm in the production of the crops is, in turn, caused by the cyclical changes in the amount of rainfall. The law of the cycles of rainfall is the law of the cycles of crops and the law of economic cycles.'" Essentially the same conclusions have been reached by Pettersson, Clayton, Brückner, and others.

Various hypotheses as to cyclic changes in climate are briefly discussed in their relation to their economic effects on man, plants, and animals.

The money value of rainfall in selected crop areas of the United States, E. J. Cragoe (*Jour. Geogr., 14 (1915), No. 1, pp. 1–6; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1574, 1575*).—This article gives in brief the results of an attempt to work out the correlation of rainfall to wheat and corn production in definite mathematical form. For example, it is calculated from the available data that the average wheat yield (bushels per acre) is about twice the number of inches of average

[a] Economic Cycles: Their Law and Cause, H. L. Moore. New York: The Macmillan Co., 1914, p. 149.

rainfall of May and June in North Dakota, 1.7 times the rainfall of these months in South Dakota, about the same as the inches of rainfall during January, February, March, and April in California, four times the inches of rainfall during these months in Washington, and less than twice the inches of rainfall of March, April, and May in Kansas and Nebraska.

In regions of ordinarily abundant (as compared with regions of deficient) rainfall, like Minnesota, Ohio, Indiana, Illinois, and Missouri, there was found to be no direct relation between wheat yield and average rainfall. "The results in all cases indicate, however, that the best crops can be expected when the rainfall is below the normal amount during the critical months of the growing season." It was found that "in average years, the yield of corn throughout the corn belt was approximately eight times the July rainfall. In the best years, however, the yield was only seven times the rainfall for this month, and in the poorest years it was ten times as great."

Correlations are made of the approximate money value of different amounts of rainfall to each crop in the area of deficient rainfall.

Protection from damage by frost, W. G. Reed (*Geogr. Rev., 1 (1916), No. 2, pp. 110–122, figs. 8*).—Conditions of frost occurrence, frost damage, methods of protection, and frost forecasting are briefly discussed. The conclusion is reached that the low temperatures resulting in frost injury "can be prevented by heating the lower air to supply the loss of heat to the cold earth and by checking radiation from the earth; mixing the air is not now practicable. The methods most successful commercially depend upon the combination of heat and smoke. The best practice is fairly clean-burning small fires, one to each one or two trees."

Relation of the soil to meterological factors, E. G. Loske (*Trudy Selsk. Khoz. Met., Nos. 8 (1911), pp. XII+104; 9 (1912), pp. XIV+105–334; 11 (1915), pp. XVII+335–600*).—The literature of investigations bearing on the subject is exhaustively reviewed and digested.

Aridity and humidity maps of the United States, M. Jefferson (*Geogr. Rev., 1 (1916), No. 3, pp. 203–208, figs. 2*).—Two maps are described in which an attempt has been made to represent simply and clearly the essential facts of rainfall "that condition life in the United States."

Agricultural meteorology in Canada, R. W. Mills (*Agr. Gaz. Canada, 3 (1916), No. 2, pp. 177–179*).—This article briefly explains the purpose and plan of the work of the department of agricultural meteorology of the Meteorological Service of Canada, which was organized in 1914 to study the relation of meteorological conditions to crop growths by methods similar to those employed in Russia.

It is stated that 14 stations well distributed over Canada were in operation in 1915 for the purpose of studying the relation of meteorological factors to the growth of spring wheat. The plan followed called for the collection of information regarding "(1) general field conditions and the farming methods employed, (2) dates of the important stages in the life of the wheat, from sowing to reaping, and the general condition of the plants at the time of the stages, (3) average height of plants on the plat every seven days, (4) the damaging effect of adverse weather phenomena on plants and soil, at any time throughout the season, losses due to meteorological and to other factors, and (5) final yield and quality." By means of a graphical method the crop notes are compared with charts showing the daily temperature, precipitation, and bright sunshine at each station throughout the growing season.

[Report of the] committee for the investigation of atmospheric pollution (*Lancet [London], No 9 (1916), I, Sup., pp. I–XL, figs. 18*).—This is the first report of the committee and covers the investigations from April, 1914, to

March, 1915. It describes the methods and apparatus adopted and results (in detail) obtained in a systematic study of the pollution of the air in and around various English cities as indicated by measurement and chemical examination of the rain water and deposits collected in special gages devised for the purpose. The data include rainfall in millimeters, and tar, ash, total solids, soluble sulphates, chlorin, and ammonia expressed in metric tons per square kilometer.

SOILS—FERTILIZERS.

A guide to the mineralogical analysis of soil, F. Seemann (*Leitfaden der Mineralogischen Bodenanalyse. Vienna: Wilhelm Braumüller, 1914, pp. IX+110, pls. 3, figs. 39*).—This book represents the author's experience as a teacher of mineralogical soil analysis, in which an effort is made to correct some of the faults of earlier methods.

The volume is divided into the following main parts: Collecting of sample; investigation of the most important physical properties of the soil; mechanical soil analysis; and mineralogical examination of soil constituents, embracing (1) methods and (2) character of the soil-forming minerals. Seven tables for the determination of minerals in the soil are included.

The data of geochemistry, F. W. Clarke (*U. S. Geol. Survey Bul. 616 (1916), pp. 821*).—This is the third edition, revised and enlarged, of this work (E. S. R., 26, p. 517).

The plasticity of clay and its relation to mode of origin, N. B. Davis (*Trans. Amer. Inst. Mining Engin., 51 (1916), pp. 451–480, figs. 4*).—Plasticity is defined, especially with reference to clay, and theories of plasticity as developed by others, based on (1) structure of clay particles, (2) presence of hydrous aluminum silicates, (3) molecular attraction between particles, and (4) presence of collodial gelatinous matter, are reviewed and discussed. The theory of suspension and emulsion colloids is reviewed and experiments on the plasticity of four excessively plastic clays are reported. A further study deals with the formation of residual and transported clays.

It is concluded that "plasticity in clays is due to the gelatinous state of matter, a state common to them because of their mode of origin. This gelatinous matter may be silicic acid gel, alumina gel, iron oxid gels, silicate gels, or organic gels. Two or more of these are usually present, and their effect will be further modified by adsorbed salts and the relative proportions of large and small grains, and to a limited extent by the shape of the grains. The particular kind and amount of gelatinous matter present, the size and shape of grain, and the relative proportions of large and small grains, are important factors in determining the other related physical properties of tensile strength and air shrinkage."

On osmosis in soils, C. J. Lynde and J. V. Dupré (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. III, pp. 69–80, figs. 2; Jour. Amer. Soc. Agron., 7 (1915), No. 6, pp. 283–292, figs. 2*).—Further experiments on the subject with a moist clay subsoil (E. S. R., 33, p. 420), for the purpose of testing phenomena observed in previous experiments, are reported. The general conclusion is drawn that "whatever the cause, water moves through clay subsoil from a weak soil solution toward a strong one. The results agree with the theory that this movement is caused by osmosis."

Salts, soil colloids, and soils, L. T. Sharp (*Proc. Nat. Acad. Sci., 1 (1915), No. 12, pp. 563–568*).—This is a general discussion of the results of investigations, to be reported in detail later, on the subject of salts in relation to soil colloids. The experiments are based largely on the striking change in physical

properties produced in soils on the addition and subsequent leaching out of salts. An attempt is made to explain this change on the basis of colloid chemistry, especially "on the contention that the behavior of soils under the influence of salts agrees in some measure with the laws which are thought to govern the behavior of dispersed systems to which salts have been added."

The adsorption of potassium and phosphate ions by typical soils of the Connecticut Valley, R. H. Bogue (*Jour. Phys. Chem., 19 (1915), No. 8, pp. 665–695, figs. 13*).—Experiments conducted at the Massachusetts Agricultural College with sand, fine sandy loam, silt loam, and clay soils to determine their adsorptive powers for potassium and phosphate ions from percolating solutions of monocalcium phosphate and potassium chlorid of concentrations equivalent to 200 parts per million of potassium and phosphoric acid, respectively, are reported. The results are presented in tabular and graphic form.

It was found that "when soils are subjected to the leaching action of water, the concentration of potassium and phosphate ions in the soil extract approaches a constant which appears to be fixed and definite for any given soil. When soils are subjected to the action of soluble potassium and phosphate salts, the concentration of these salts in the soil extract is at first not materially increased owing to the power of the soils to adsorb these salts, but as adsorption proceeds it becomes weaker and a point is finally reached where the amount of soluble salts in the soil extract is nearly equivalent to the amount applied. The concentration of the potassium and phosphate ions in the soil extract approaches a low constant, which appears to be fixed and definite for each soil, when only a part of the adsorbed ions has been removed by the leaching action of water.

"The constants attained by the four soils by the leaching action of water are very nearly alike, which would seem to indicate that the concentration of the potassium and phosphate ions in the soil solutions of the various soils were practically the same, and not at all dependent on the amount of adsorbed potassium or phosphate they originally contained. These results substantiate the theory that the concentration of salts in the soil solution is very largely dependent on the specific adsorptive capacity of the individual soil . . . [They] tend to disprove the theory that the composition of the soil moisture, hence the adsorptive capacity of the soil, is determined primarily by the chemical composition of the soil, but tend rather to prove this quality to be dependent on the mechanical texture of the individual soil."

The results are also taken to indicate that the soils were able to take up the potassium and phosphoric acid by both physical and chemical processes.

Soil survey of Mississippi County, Arkansas, E. C. Hall, T. M. Bushnell, L. V. Davis, W. T. Carter, Jr., and A. L. Patrick (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 42, pl. 1, fig. 1, map 1*).—This survey, issued April 4, 1916, deals with the soils of an area of 575,360 acres in northeastern Arkansas which lies within the River Flood Plains soil province and comprises first and second bottom lands. In general the topography varies little from a nearly flat and level plain. The natural drainage of the county is generally poor owing to the low-lying position of the soils and to the annual overflows of the Mississippi River. The soils range from loose, incoherent sands to heavy, plastic clays and are of alluvial origin. Including meadow and overwash, 22 soil types of 6 series are mapped, of which the Sharkey clay covers 64.7 per cent of the area.

Soil survey of Webster Parish, Louisiana, A. H. Meyer, E. S. Vanatta, B. W. Tillman, and R. F. Rogers (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 40, fig. 1, map 1*).—This survey, made in cooperation with the Louisiana Experiment Station and issued March 11, 1916,

deals with the soils of an area of 389,760 acres in northwestern Louisiana which lies wholly within the Coastal Plain province. The topography varies from flat to rolling and consists of sedimentary uplands, alluvial terraces, and first bottom lands. In addition to meadow, 21 soil types of 11 series are mapped, of which the Ruston, Susquehanna, Ocklocknee, and Lufkin very fine sandy loams cover 30.9, 12.4, 10, and 9.9 per cent of the area, respectively.

Soil survey of Montgomery County, Maryland, W. T. Carter, Jr., and J. P. D. Hull (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 39, pls. 5, fig. 1, map 1*).—This survey, made in cooperation with the Maryland Geological Survey and issued March 25, 1916, deals with the soils of an area of 309,760 acres in the center of the southwestern boundary of Maryland.

"The topography varies from almost level or gently rolling to strongly rolling and hilly, being prevailingly rolling. . . . Throughout the county the surface drainage is good." The area lies almost entirely within the Piedmont Plateau province, only a narrow strip being in the Coastal Plain province. The soils are grouped as (1) residual soils and (2) soils derived from the unconsolidated material of the Coastal Plain and recently deposited material along streams. Seventeen soil types of 13 series are mapped, of which the Chester loam is the most extensive type and is considered the most important soil in the county. It covers 40.4 per cent of the area and the Manor loam covers 16.9 per cent.

Soil survey of Clinton County, New York, E. T. Maxon and W. R. Cone (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 37, fig. 1, map 1*).—This survey, made in cooperation with the New York State College of Agriculture and issued March 18, 1916, deals with the soils of a well-drained area of 671,360 acres in northeastern New York. The topography is rolling to hilly and precipitous. The soils are of glacial, lacustrine, and alluvial origin. Exclusive of six miscellaneous types, 26 soil types of nine series are mapped, of which the Coloma soils are the most extensive types, the Coloma stony fine sandy loam and fine sandy loam covering 21.5 and 17.1 per cent of the area, respectively. The Gloucester stony fine sandy loam covers 13.9 per cent of the area.

Soil survey of Trumbull County, Ohio, G. N. Coffey, J. Woodward, and J. M. Snyder (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 53, figs. 2, map 1*).—This survey, made in cooperation with the Ohio Experiment Station and issued March 21, 1916, deals with the soils of an area of 405,120 acres in northeastern Ohio, the surface of which is level to rolling with some small areas of steep and hilly land.

Trumbull County lies entirely within the late Wisconsin glaciation and the soils are almost entirely of glacial origin. Including muck and peat, 23 soil types of 11 series are mapped, of which the Volusia clay loam and silt loam cover 23.2 and 20.3 per cent of the area, respectively, and the Trumbull clay loam and silt loam 13.9 and 10 per cent of the area, respectively.

Soil survey of Raleigh County, West Virginia, W. J. Latimer (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 34, fig. 1, map 1*).—This survey, made in cooperation with the West Virginia Geological Survey and issued March 28, 1916, deals with the soils of an area of 391,040 acres in southern West Virginia lying wholly within the Allegheny Plateau. The greater part of the surface of the county is extremely rough and dissected. The soils are of residual, old alluvial, and alluvial origin. Including rough stony land, 14 soil types of 5 series are mapped, of which the Dekalb series, including silt loam, stony silt loam, silty clay loam, stony loam, loam, and fine sandy loam, constitute 82.8 per cent.

Soil survey of Fond du Lac County, Wisconsin, A. R. WHITSON, W. J. GEIB, L. R. SCHOENMANN, F. L. MUSBACH, G. CONREY, and A. E. TAYLOR (*Wis. Geol. and Nat. Hist. Survey Bul. 37 (1914), Soil Ser. 7, pp. 84, pls. 5, figs. 2, map 1*).—This survey, made in cooperation with the Bureau of Soils of this Department, was noted in the report of the field operations of that Bureau for 1911 (E. S. R., 31, p. 513).

Soil survey of Juneau County, Wisconsin, A. R. WHITSON, W. J. GEIB, L. R. SCHOENMANN, C. A. LECLAIR, O. E. BAKER, and E. B. WATSON (*Wis. Geol. and Nat. Hist. Survey Bul. 38 (1914), Soil Ser. 8, pp. 92, pls. 5, figs. 2, map 1*).—This survey, made in cooperation with the Bureau of Soils of this Department, was noted in the report of the field operations of that Bureau for 1911 (E. S. R., 31, p. 513).

Soil survey of Kewaunee County, Wisconsin, A. R. WHITSON, W. J. GEIB, E. J. GRAUL, and A. H. MEYER (*Wis. Geol. and Nat. Hist. Survey Bul. 39 (1914), Soil Ser. 9, pp. 83, pls. 3, figs. 2, map 1*).—This survey, made in cooperation with the Bureau of Soils of this Department, was noted in the report of the field operations of that Bureau for 1911 (E. S. R., 31, p. 513).

Soil survey of La Crosse County, Wisconsin, A. R. WHITSON, W. J. GEIB, T. J. DUNNEWALD, and C. LOUNSBURY (*Wis. Geol. and Nat. Hist. Survey Bul. 40 (1914), Soil Ser. 10, pp. 76, pls. 5, figs. 2, map 1*).—This survey, made in cooperation with the Bureau of Soils of this Department, was noted in the report of the field operations of that Bureau for 1911 (E. S. R., 31, p. 513).

The chemical composition of virgin and cropped Indiana soils, S. D. CONNER (*Proc. Ind. Acad. Sci., 1914, pp. 359–363*).—Chemical analyses, made at the Indiana Experiment Station, of 31 composite samples of virgin and cropped Indiana soils and subsoils (the top 6.5 in. and the layer from a depth of 12 to 18 in.) show that "the most serious losses from the standpoint of soil fertility are those of nitrogen, which shows a loss of 28 per cent, and the organic matter, which shows a loss in the volatile matter of 26 per cent and in the humus of 47 per cent. . . . While the phosphoric acid and potash show only about 10 per cent loss this 10 per cent was the most available portion of these important elements." There was little difference in the contents of sulphur, calcium, and magnesium in virgin and cropped soils, but quite a loss of manganese in the cropped soil. "While the acidity of the cropped soil has increased, the acidity of the cropped subsoil has decreased."

Plant food in Aroostook soils, C. D. WOODS (*Maine Sta. Bul. 246 (1916), pp. 14–16*).—Analyses of ten samples of the soils of Aroostook County, Me., are reported showing total nitrogen varying from 0.113 to 0.281 per cent, potash soluble in hot strong hydrochloric acid varying from 0.27 to 0.369 per cent, phosphoric acid soluble in hot strong hydrochloric acid varying from 0.151 to 0.32 per cent, and lime varying from 0.11 to 0.31 per cent.

A peculiar clay from near the City of Mexico, E. W. HILGARD (*Proc. Nat. Acad. Sci., 2 (1916), No. 1, pp. 8–12*).—Attention is drawn to a new type of so-called clay soil, samples of which were obtained from an unproductive farm in the vicinity of Mexico City, Mexico.

The clay showed marked swelling properties in contact with water and was very plastic when wet. After protracted boiling of a sample of the clay "the suspension . . . showed a multitude of dark rounded particles, very uniformly distributed through a colloidal medium of faintly yellowish tint. . . . All attempts to free the colloidal ingredients from the visibly discrete particles by sedimentation proved futile. The suspension was readily coagulated and precipitated, apparently unchanged, by a solution of sodium chlorid. On washing by decantation the suspension was again readily made, the microscopic character also remaining the same."

Data from chemical analyses of the clay "show clearly a totally different composition from any 'clay' on record. The alumina present is far below any reasonably assumable compound with the soluble silica; the predominant base being evidently magnesia, and that greatly in excess of the lime present."

The name Lucianite is suggested.

Analyses of Queensland soils, J. C. BRUNNICH (*Ann. Rpt. Dept. Agr. and Stock [Queensland], 1914–15, pp. 34–49*).—Chemical analyses of 152 samples and physical and mechanical analyses of 136 samples of Queensland soils are reported.

Some preliminary investigations into the chemical composition of certain vineyard soils in the Montagu and Robertson districts, A. I. PEROLD and D. C. CRAWFORD (*So. African Jour. Sci., 11 (1915), No. 9, pp. 337–349*).—Analyses of 80 samples of the soil, and where possible of the subsurface and subsoil, from these two districts of Cape Colony are reported and discussed. The samples were taken at three depths, namely, from 0 to 12 in., from 12 to 30 in., and from 30 to 48 in. The soils are of alluvial and residual origin, the former varying in texture from loose loams to heavy clay loams, and the latter being nearly all of a clayey nature.

The results of the analyses are taken to indicate that the nitrogen and phosphoric acid contents of these soils are relatively low, while the contents of potash and lime in most cases reach the average and in some cases exceed it. Many of the soils showed a lower potash content than the corresponding subsoils, especially the residual soils. The nitrogen and phosphoric acid contents of the subsoils were almost invariably less than those of the surface soils.

Relation of carbon bisulphid to soil organisms and plant growth, E. B. FRED (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 1, pp. 1–19, pls. 2*).—Experiments conducted at the Wisconsin Experiment Station on the effect of carbon bisulphid (1) on the number and activity of soil organisms of a silt loam soil, (2) on buckwheat, clover, corn, mustard, oats, and rape in silt loam soil and in silt loam and sand mixed, sand, clay, loam, silica sand, and acid soil, and (3) on reinoculated soil and the accumulation of sulphates in soil are reported, continuing previous work (E. S. R., 27, p. 131). The following conclusions are drawn:

"The addition of carbon bisulphid to soil exerts a decided effect on the fauna and flora of the soil, characterized by a temporary reduction in the number of micro-organisms. Later, an enormous multiplication of bacteria takes place and an almost parallel increase in production of by-products or soluble nitrogen is noted. The ammonia content seems to follow the curve of bacterial growth and later gives way to larger amounts of nitrate. . . . It seems that carbon bisulphid in soil produces an increase in soluble compounds of nitrogen and sulphur.

"In Miami soil carbon bisulphid benefited the growth of buckwheat, oats, and mustard. No relation seems to exist between plant stimulation with carbon bisulphid and the form of the soluble nitrogen. In nonacid soils carbon bisulphid is most beneficial to sulphur crops. Mustard offers a good example. In all of the experiments, except on acid soils, mustard showed an increased growth from the use of carbon bisulphid. Carbon bisulphid in peat soil greatly benefits the growth of red clover. In sand cultures plus soluble plant food carbon bisulphid favors the growth of certain plants.

"The data show clearly that carbon bisulphid does not act alike in all soils or toward all crops."

The effect of heat upon soil fertility, W. L. OWEN (*Sugar [Chicago], 17 (1915), No. 10, pp. 31, 32*).—This is a brief review of work by others on partial

sterilization of soils by antiseptics and heating. It is thought that the benefits which result from heating the soil are partly biological and partly chemical.

The influence of nitrification upon soil fertility, W. L. OWEN (*Sugar* [*Chicago*], *17* (*1915*), *No. 11, pp. 30, 31*).—From a review of work bearing on the subject conducted at some of the state experiment stations and at foreign experiment stations, the author concludes that cotton-seed meal is superior to ammonium sulphate, due to the neutralization of the soil acidity in the former case by the formation of ammonia.

Physical-chemical studies of soil.—III, The conditions of humidity of soils and the absence of vegetation, U. PRATOLONGO (*Staz. Sper. Agr. Ital., 48* (*1915*), *No. 1, pp. 44–56; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 5, p. 660*).—Experiments, based in part on work previously noted (E. S. R., 30, p. 215), with rye, oats, clover, vetch, mustard, and flax, on four different arable soils of alluvial origin, and one clay soil, are reported. The purpose was to determine the relation between the initial wilting point of the plant on the one hand and the water content of the soil at the initial wilting point and the chemical and physical properties of the soil on the other. In the experiments normal conditions were maintained during the germination and growth of the crops until a height of from 10 to 12 cm. (3.94 to 4.73 in.) was reached, after which all conditions were maintained normal except moisture, the content of which was gradually decreased.

It was found that a constant relation existed between the water contents of the different soils at the initial wilting point of vegetation and the so-called "deviation" in the Van Bemmelen water vapor tension curve for the same soils, the average coefficient of proportionality being 5.06±0.08. No essential difference was observed in the different crops in regard to their resistance to the gradually increasing aridity of the soils.

Effect of vanillin as a soil constituent, J. J. SKINNER (*Plant World, 18* (*1915*), *No. 12, pp. 321–330, figs. 5*).—The substance of this paper has been previously noted from another source (E. S. R., 32, p. 619).

Experiments on lime determination in agricultural soil by more recent methods, W. BANDI (*Jahresber. Landw. Schule Rütti, 1912–1914, pp. 149–154*).—Experiments with 130 samples of soils of varying textures are reported, in which the extent of effervescence with hydrochloric acid, the amount of calcium oxid soluble in ammonium chlorid, the reaction to litmus, and the power of sustaining the development of Azotobacter in a nutritive medium were observed for each sample.

The results are taken to indicate that the simple hydrochloric acid test for the lime requirement of soil is in general sufficient. If a soil effervesces with hydrochloric acid it is considered to need no lime. A quantitative determination of carbon dioxid is considered superfluous on the grounds that the hydrochloric acid test is equally effective within practical limits. On the other hand, if there is no effervescence with hydrochloric acid the reaction toward litmus should be determined. If alkaline, this indicates that no lime is needed, but if acid, shows a need for lime. If the reaction toward litmus is neutral the power of supporting a growth of Azotobacter should be tested.

See also previous notes by Christensen (E. S. R., 24, p. 527; 34, p. 813).

Plant foods for crops in 1916, L. L. VAN SLYKE (*New York State Sta. Circ. 47* (*1916*), *pp. 8*).—This circular presents the consensus of opinion of the members of a conference of representatives of the agricultural experiment stations of the New England States, New Jersey, and New York called for the purpose of discussing the effects of the war upon the cost of plant-food materials and furnishing suggestions to farmers as to practical methods to adopt during 1916 under present conditions.

Experiments with fertilizers, F. E. Bear (*West Virginia Sta. Bul. 155 (1915), pp. 19, figs. 11*).—This bulletin gives the results to date of experiments partly reported upon in previous bulletins of the station (E. S. R., 24, p. 716).

A summary of the 15 years' experiments indicates that every ton of manure applied alone has produced an increase per ton valued at $3.12, and that for every dollar invested in them acid phosphate, sodium nitrate, and potassium sulphate when applied alone have given average increases valued at $4.63, 34 cts., and 37 cts., respectively. Sodium nitrate and acid phosphate applied in combination gave two and a quarter times as much increase per acre as acid phosphate alone, and sodium nitrate, potassium sulphate, and acid phosphate applied in combination gave three times as much increase per acre as acid phosphate alone. Every dollar invested in lime and applied in connection with complete fertilizer gave an increase valued at $1.35.

It is concluded that acid phosphate is of great importance as a fertilizer in the State. From the results obtained with acid phosphate and sodium nitrate it is further concluded "that if more legumes had been grown on the soil and the amount of nitrogen in the soil had been increased thereby we could expect a greater return from the use of acid phosphate on the plat receiving acid phosphate alone."

Culture experiments with nitrogenous fertilizers, A. von Reibnitz (*Ztschr. Landw. Kammer Schlesien, 19 (1915), Nos. 18, p. 536; 19, pp. 567, 568*).—Two years' field experiments with sugar beets and wheat on a mild loam soil to determine the relative fertilizing values of lime nitrogen, Norwegian nitrate, and sodium nitrate, when added in amounts equivalent to 15 and 25 lbs. of nitrogen per acre, showed that lime nitrogen had practically no effect on the beets, while Norwegian nitrate and sodium nitrate caused marked and about equal increases. Both the nitrates had a much more favorable effect on wheat than lime nitrogen. It is considered inadvisable, therefore, to use lime nitrogen on beets or to use more than 10 lbs. of nitrogen per acre in the form of lime nitrogen on wheat. It is thought further that lime nitrogen should be applied some time before seeding and be thoroughly mixed with the soil.

Granulated calcium cyanamid (Norwegian lime nitrogen), S. Hals (*Tidsskr. Norske Landbr., 22 (1915), No. 8, pp. 332–340; Zentbl. Kunstdünger Indus., 20 (1915), No. 21, pp. 264–266*).—The process of manufacture of granulated Norwegian lime nitrogen is described and a comparison of its chemical composition with that of the common dusty cyanamid is drawn.

The results indicate that the solubilities in water of the nitrogen of the two fertilizers are about equal. The nitrogen in both fertilizers is present as calcium cyanamid and as dicyandiamid, the latter being the prevailing form in Norwegian lime nitrogen. The coarser grains of the Norwegian lime nitrogen were somewhat more slowly soluble in water than the finer grains. Norwegian lime nitrogen when mixed with superphosphate had a less marked tendency to fix the soluble phosphate in insoluble form than had cyanamid.

Acid soils and the effect of acid phosphate and other fertilizers upon them, S. D. Conner (*Jour. Indus. and Engin. Chem., 8 (1916), No. 1, pp. 35–40, figs. 2*).—Experiments on the effect of neutral normal solutions of salts on acid soils and of heat and phosphates on soil acidity are reported. The soluble salts used were the sulphate, acetate, chlorid, and nitrate of potassium, sodium, and magnesium, the acetate, chlorid, and nitrate of calcium, and the acetate and chlorid of barium.

It was found that "various acid constituents of soils show different degrees of reactivity with different bases, also with the same base when free or when combined with different acids. . . . When aluminum silicates are treated with a solution of potassium hydroxid, heat is developed with the acid silicates

but not with neutral silicates. The heat developed is proportional to the acidity, indicating a chemical rather than a physical reaction. The acidity of aluminum silicates is not only in proportion to the ratio of Al_2O_3 to SiO_2 but also in proportion to the water of constitution. The greater the proportion of water in the silicate the more acid is the reaction. Heating and the consequent driving off of water of constitution in acid aluminum silicates lower the acidity until all the water is removed when neutrality is reached. Ignition of acid soils also destroys the acidity. Much of the harmful acidity of acid soils is due to the presence of toxic acid salts of aluminum and iron. The immediate effect of the addition of soluble fertilizer salts of the strong acids (nitric, hydrochloric, and sulphuric) to acid soils is to increase the soluble acid salts of aluminum and iron."

In field and laboratory experiments it was found that "soils treated for 20 years with acid phosphate show less acidity than soils that have never had acid phosphate. Acid soils and silicates treated in the laboratory with acid phosphate show less soluble acidity than untreated soils and silicates."

A new method of estimating soil acidity, in which the catalysis of ethyl acetate is taken as a measure of the solubility, is described, which is used together with the potassium nitrate method of Hopkins, Knox, and Pettit and the limewater method of Veitch (E. S. R., 14, p. 111).

Phosphatic fertilizers and the root system of beets, V. I. SAZANOV (*Zhur. Opytn. Agron., 16 (1915), No. 2, pp. 140–165, figs. 18; abs. in Chem. Abs., 9 (1915), No. 17, p. 2419*).—Box experiments on chernozem soil to determine the influence of superphosphate on the development of the root system of beets are reported.

It was found that soluble phosphoric acid was fixed in the layer of chernozem soil to which it was added, and that no considerable amount of phosphoric acid was displaced and transferred from one layer to another. Superphosphate was favorable to the extensive development of beet roots, notably in the layer of soil to which it was added. No similar influence of superphosphate on the roots of wheat and rye was observed.

Phosphate rock, W. H. WAGGAMAN (In *The Mineral Industry: Its Statistics, Technology, and Trade During 1914. New York and London: McGraw-Hill Book Co., 1915, vol. 23, pp. 584–601*).—This article deals with the production of phosphates in the United States and in foreign countries, it being stated that the world's production of phosphate rock in 1913 amounted to over 6,780,000 tons. In 1914 the total output was less than 4,000,000 tons, of which the United States produced 2,752,971 tons and consumed 1,823,978 tons. Methods for the production of soluble phosphate from phosphate rock are briefly described, and a bibliography of works bearing on the subject is appended.

Potassium salts, S. H. DOLBEAR (In *The Mineral Industry: Its Statistics, Technology, and Trade During 1914. New York and London: McGraw-Hill Book Co., 1915, vol. 23, pp. 611–622*).—This report deals with the sources and production of potash salts in the United States and foreign countries and the imports and exports of the same, with special reference to the years 1910 to 1914. A bibliography of works bearing on the subject is appended.

Investigation of sources of potash in Texas, W. B. PHILLIPS (*Trans. Amer. Inst. Mining Engin., 51 (1916), pp. 438–450, figs. 3*).—This is a discussion of the potash resources of Texas, from which it is concluded that the only hopeful outlook for the existence of workable sources of potash salts in Texas is in the direction already indicated by Udden (E. S. R., 34, p. 26) and in the region southeast of and bordering on New Mexico.

Potassium salts in Catalonia, C. RUBIO and A. MARÍN (*Bol. Inst. Geol. España, 2. ser., 14 (1914), pp. 173–230; rev. in Econ. Geol., 10 (1915), No. 6, pp. 586–588*).—This report deals mainly with the geology of the recently discovered deposits of potassium salts in Catalonia, Spain.

It is stated that the deposits of salts occur in a basin of marine sediments of Eocene and Oligocene age. The most important developments have been undertaken near the town of Suria. The tonnage of potassium salts in this neighborhood computed on a provisional basis is carnallite 2,550,000 tons and sylvinit 1,125,000 tons. It is stated that the carnallite of Suria is of a very red color and contains from 11.52 to 15.26 per cent of potassium oxid.

German and other sources of potash supply, C. H. MACDOWELL (*Trans. Amer. Inst. Mining Engin., 51 (1916), pp. 424–437*).—A discussion is given of German and other sources of potash, with special reference to their commercial aspects.

Sodium and sodium salts, S. H. SALISBURY, JR. (In *The Mineral Industry: Its Statistics, Technology, and Trade During 1914. New York and London: McGraw-Hill Book Co., 1915, vol. 23, pp. 665–682*).—This report deals with the world's production of sodium salts, especially sodium nitrate, with special reference to 1914 and previous years. A bibliography of works bearing on the subject is appended.

Limestone: North Island analyses, B. C. ASTON (*Jour. Agr. [New Zeal.], 11 (1915), No. 3, pp. 235–240*).—Analyses of 242 samples of limestone from North Island, New Zealand, are reported.

A waste lime product, C. E. THORNE (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 101, 102*).—Attention is drawn to the value of the waste lime products from sodium carbonate factories as a lime fertilizer.

The use of peat in commercial fertilizer, H. E. WILDEMAN (*Jour. Amer. Peat Soc., 9 (1916), No. 1, pp. 28–35*).—A discussion of the use of peat as a fertilizer filler is given, together with a review of experiments from various sources on the availability of the nitrogen of peat.

AGRICULTURAL BOTANY.

Relation of green manures to the failure of certain seedlings, E. B. FRED (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 25, pp. 1161–1176, pls. 2*).—In a previous report (E. S. R., 28, p. 816), a decreased germination of cotton was noted immediately following green manures. In the present paper the author describes a more extensive investigation of this phenomenon, conducted at the Wisconsin Experiment Station.

The results of a series of laboratory studies indicate that green manures may seriously injure the germination of certain seeds. This is believed to be brought about by the action of certain parasitic fungi, the development of which is favored by the decomposition of the green manure plants. As a rule, oil seeds are easily damaged, while starchy seeds on the contrary are quite resistant. Cotton seed and soy beans seem to be extremely sensitive to conditions resulting from green manuring, and the germination of flax, peanuts, hemp, mustard, and clover is reduced somewhat by the presence of decomposing plant tissue. The damage to oil seeds from green manuring seems to be confined largely to the first stages of decomposition, and experimental evidence seems to indicate that two weeks after green manure is added, it does not cause any injury to the seeds. Small applications of calcium carbonate seem to increase the injury to germination. The rate of germination was found to determine to a certain extent the degree of injury, slow germination being marked by a high percentage of diseased seedlings.

Activities of the micro-organisms of the soil (*North Dakota Sta. Rpt. 1915, pt. 1, pp. 16, 17*).—A study is in progress to determine and control the optimum conditions for the maximum efficiency of micro-organisms concerned in soil fertility. The work of the past year is said to have demonstrated that the energy material, consisting mainly of carbohydrates and their decomposition products, is the chief factor governing ammonification. As long as readily available energy material is present in excess of the required ratio to nitrogen demanded by ammonifying organisms, a minimum amount of nitrogen will be accumulated. However, when the readily available amount of energy material falls below the necessary ratio to nitrogen required by ammonifying organisms, the phenomena of ammonification will take place, although, if the energy material becomes too low, the ammonifying phenomena will be almost, if not entirely, lost.

As a result of this study, it is believed that ammonification is a doubtful criterion for measuring soil fertility.

Fission fungi which decompose urea and form nitrates, M. DÜGGELI (*Naturw. Wchnschr., 30 (1915), No. 20, pp. 305–315*).—This is a somewhat general discussion of the biology of some fission fungi and the chemical changes connected with their activities.

Enzym action in the marine algæ, A. R. DAVIS (*Ann. Missouri Bot. Gard., 2 (1915), No. 4, pp. 771–836*).—Difficulty having been experienced in demonstrating enzym action in *Fucus vesiculosus* (E. S. R., 30, p. 728), the investigation was extended to certain representative forms of the three great groups of the marine algæ in order to ascertain whether this apparent inactivity is characteristic of the algæ and to add to the knowledge of the general metabolism of the group.

The data obtained are thought to show that the number of enzyms in algæ that can be isolated by standard methods is small. This seems to be true especially of the brown algæ. The enzyms which were found in fresh or dried algal tissue include carbohydrases hydrolyzing the polysaccharids, starch, dextrin, glycogen, and laminarin, but not those hydrolyzing the several disaccharids employed as substrates; lipases acting upon neutral fats but not upon the esters of the lower fatty acids; proteinases; nucleases; oxidases and peroxidases; and catalases. Negative results were obtained from cellulase, cytase, maltase, lactase, sucrase, amidase, and esterase. The action of all the enzyms isolated was very slow.

An extensive bibliography is given.

On the action of pectase, N. G. BALL (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 28, pp. 349–357, fig. 1*).—This is an attempt to study the action of pectase by observing the electrical conductivity of a solution of pectin obtained from roots of *Daucus carota* when acted upon by the enzym, and also by determining the change in viscosity.

It has been found that during the action of pectase on the solution of pectin the electrical conductivity of the solution remains constant, indicating the formation of a gel and not merely a very viscous liquid. The activity of the enzym is much greater at 14° C. than at 0°, as evidenced by changes in viscosity during coagulation. The viscosity was found to increase slowly at first, then more rapidly to a maximum, followed by a rapid decrease. Increase of electrolytes present lowered the maximum, while a decrease raised it. The decrease in viscosity is thought to be explainable by the action of the electrolytes in clumping together the particles of colloid forming the reticulum of the gel, so that a suspension is produced.

Osmotic pressures in plants.—IV, On the constituents and concentration of the sap in the conducting tracts, and on the circulation of carbohydrates

in plants, H. H. DIXON and W. R. G. ATKINS (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 31, pp. 374–392, figs. 6*).—The authors, having followed up their previous work (E. S. R., 30, p. 523), give the results of observations on the sap drawn from the conducting tracts of several trees by centrifuging sections 10 cm. long by 2 cm. in diameter. The sap obtained by this method was neutral to litmus and clearer and much less concentrated than that obtained by pressure with consequent bursting of the cells.

Sugars were found at all times in the trees examined, being usually more plentiful than electrolytes. Sugars showed the greatest concentration in early spring, a dilution in spring and summer progressing to a minimum concentration in summer or autumn, then a rise in concentration, slow at first, culminating in the vernal maximum, which also coincided with the period of greatest root pressure and was simultaneous with or just preceded the opening of the leaf buds. These changes in concentration were due largely to changes in the transpiration rate.

The conveyance upward of carbohydrates, notably sucrose, is apparently a primary and continual function of the tracheæ. The sheath of wood parenchyma round the vessels functions as a gland to secrete carbohydrates into the rising transpiration stream. The relation of the medullary rays to these sheaths supports the view that they convey the carbohydrates from the bark to the glandular sheaths. The abundant presence of soluble carbohydrates in the wood sap of roots probably causes root pressure and bleeding by producing an osmotic pressure across the root cortex, which acts as a semipermeable membrane. The concentration of the carbohydrates is generally greater in the tracheæ of the stem than in those of the root, except during the summer. The electrolytes, however, are generally present in greater quantity in the root.

In general the vessels function, when water is abundant, to convey rapidly solutions of organic and inorganic substances to the leaves. The columns of tracheids may be supposed to afford a permanent channel for water and salts, and to a less degree, for the organic substances. Even in times of greatest drought, this is never put out of action.

A bibliography is given.

Osmotic pressures in plants.—V, Seasonal variations in the concentration of the cell sap of some deciduous and evergreen trees, H. H. DIXON and W. R. G. ATKINS (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 34, pp. 445–461, figs. 5*).—The authors continue this series (see above) by reporting, with certain additions, the results of a revision, the necessity for which has been previously indicated (E. S. R., 29, p. 828). The sap for freezing-point determinations and conductivity measurements was pressed from tissues previously frozen in liquid air.

The authors state that the osmotic pressures in tissue and their variations are largely due respectively to dissolved carbohydrates and to fluctuations therein, but that electrolytes also play a part. A progressive average rise in the osmotic pressure has been found during the development and life of each organ examined. This is due in case of leaves to the accumulation of electrolytes with age, but in case of the only root examined, to carbohydrates.

The leaves of the two evergreens examined possessed higher osmotic pressure during the winter than during the summer months. The curve of seasonal variations in leaves of *Hedera helix* was alike for specimens growing either in a sunny or a shaded position, but on the whole the osmotic pressure was somewhat higher for the insolated leaves. The osmotic pressure of the root sap of *Ilex aquifolium* rose from a minimum of 6 atmospheres in October to a maximum of 14 atmospheres in September.

No concentration of electrolytes with age was observed in these roots. The higher osmotic pressure in older roots is ascribed to increased carbohydrates. In each case the concentration of the total solutes of the sap expressed after freezing was greater than that of sap pressed from the same tissues untreated. The seasonal variations in concentration of the sap obtained by the two methods showed a remarkable similarity.

Some researches in experimental morphology.—I, On the change of the petiole into a stem by means of grafting, J. DOYLE (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 33, pp. 405–444, pls. 7, figs. 3*).—This is an account of attempts to ascertain whether the petiole of a plant can be made to function as a stem and to study any accompanying anatomical changes. The plants used were *Pelargonium zonale meteor, Solanum richardi, S. balbesii, Sanchezia nobilis,* and *Phytolacca dioica.* The technique, progress, and results of the work are described.

It is stated that the petiole, by grafting a sprout upon it, can be made to assume the functions of a stem. The properties of the stem, such as long life duration, indefinitely active cambium, interfascicular cambium linking up bundles, peridermium development, and considerable secondary thickening, all appear in the petiole. It is held that the causes of the secondary thickening lie in the removal of correlational influences, increased mechanical strain, and some influence connected with foliar development, supposedly bound up in some way with the water economy, particularly transpiration.

A bibliography is appended.

An investigation of the causes of automatic movements in succulent plants, EDITH B. SHREVE (*Plant World, 18 (1915), Nos. 11, pp. 297–312, figs. 6; 12, pp. 331–343, figs. 5*).—As the result of a study carried out on a number of cacti it is claimed that the seasonal movements observed are correlated with turgidity changes, as were also daily movements which were studied in some detail. Other influences acting in the case of short period movement, through intermediate processes, are temperature, light intensity, evaporative power of the air, and water content of the soil and plant tissue.

It is claimed that the form of the adult cactus plant and the position of its branches are determined by the water relations existing during the period of growth and secondary thickening of its various parts, and not by any peculiarities in its growing point and in its mode of initiating branches.

The relation of evaporation and soil moisture to plant succession in a ravine, F. T. ULLRICH (*Bul. Ill. State Lab. Nat. Hist., 12 (1915), Art. 1, pp. 16, pls. 19*).—The author gives an account, with interpretation and discussion of results, of a study during the summer of 1913 on the evaporation rates in different portions of a ravine which is described. The data obtained are claimed to show clearly that the differences in the rates of evaporation at the various stations are sufficient to indicate that the atmospheric conditions are effective factors in causing plant succession in a ravine.

A study of the relation of transpiration to the size and number of stomata, W. L. C. MUENCHER (*Amer. Jour. Bot., 2 (1915), No. 9, pp. 487–504, figs. 3*).—From the determinations made by the methods described upon a number of plants, the author concludes that the number of stomata per unit of leaf surface varies simultaneously with the length of the pore for the several species, so that two variables are to be considered. No correlation was found between the amount of transpiration and the length of the pore of one stoma or the number of stomata per unit of leaf surface in the different species investigated. No constant relation was found between the amount of water lost and the number of linear units of stomatal pore, that is, the number of stomata per unit

of leaf surface multiplied by the length of the average pore in the various species studied.

It is thought probable, therefore, that the amount of transpiration is not governed entirely by stomatal regulation, and that the variations in the amount of water loss in different species can not be accounted for by the size and number of stomata, but may be explained perhaps by a complex of several factors.

A short bibliography is appended.

The utilization by plants of acids and bases from different nitrates, B. M. Arnoldi (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), 9 (1913), pp. 407–430*).—It is stated that nitric acid is taken up from its salts more rapidly than are the bases potassium, sodium, calcium, or ammonium. The energy of absorption varies, however, with the different metals. Nitrates were in part utilized in darkness by the plant.

The influence of alkaline reactions shown by solutions after repeated use, M. A. Starodubowa (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), 9 (1913), pp. 392–406*).—It was found, contrary to expectation, that in case of oat and wheat plantlets permitted to sprout and grow for not over two weeks in a 0.2 per cent solution of sodium nitrate, the seedlings showed some actual increase of vigor in spite of the increased alkalinity until the eighth successive series had been grown in the medium. This, it is thought, may indicate that the supposed excretion of harmful substances from such sprouting plants does not begin in these plants before they are two weeks old.

Toxicity of galactose for certain of the higher plants, L. Knudson (*Ann. Missouri Bot. Gard., 2 (1915), No. 4, pp. 659–666, pl. 1*).—Experiments with vetch having shown marked injury following the use of galactose in a nutrient medium, tests were made on other leguminous plants to determine whether or not the effect of the galactose is consistent.

It was found that, while other sugars acted beneficially, galactose showed an injurious action on *Vicia villosa* and *Pisum sativum*. It does not appear to be toxic to fungi, since several of these were found growing in cultures which had become contaminated therewith. The character of the injury and the method of action by galactose have not yet been determined. It apparently kills the cells with which it comes in contact. Glucose appears to neutralize the toxicity of galactose in some way not yet understood.

Fumigation experiments to determine the effect of highly diluted sulphur dioxid on a growing grain crop, A. E. Wells (*U. S. Dept. Int., Bur. Mines Bul. 98 (1915), pp. 213–307, pls. 13, fig. 1*).—This is the author's report to the Selby Smelter Commission.

The tests were carried out with barley in actual cultivation, an improved method of sulphur dioxid gas delivery being employed which reproduced, as regards maintenance of uniformity, actual outside conditions as nearly as possible. It is stated that, next to concentration of sulphur dioxid, duration of exposure thereto is the chief element in the causation of injury, and that the effects of the time factor are not materially altered when the applications are made at intervals, provided these are short. The humidity of the atmosphere is also a strong determinative factor, exceeding in importance temperature changes and the influence of sunlight and shade.

A preliminary account of a new œdanometer for measuring the expansive force of single seeds, or similar small bodies, when wetted, J. B. Butler and J. M. Sheridan (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 35, pp. 462–480, figs. 4*).—It is claimed for this device that it measures the force rather than the volume of the swelling. The several forms are designed to measure pressures due to the swelling of single seeds as well as of quantities sufficient to fill considerable space.

Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from October 1 to December 31, 1913 (*U. S. Dept. Agr., Bur. Plant Indus. Inventory No. 37 (1916), pp. 95, pls. 6*).—Notes are given of seeds and plants imported from various sources from October 1 to December 31, 1913, about 700 numbers being included. These were largely obtained from an expedition to Brazil made by P. H. Dorsett, A. D. Shamel, and W. Popenoe, a collection by S. C. Mason in Egypt and Nubia, and collections by F. N. Meyer in China.

International catalogue of scientific literature. M—Botany (*Internat. Cat. Sci. Lit., 11 (1914), pp. VIII+856*).—The literature herein catalogued is said to be mainly that of 1911, but to include some entries dated 1912 and portions of the literature of 1901 to 1910, the index slips for which were received too late for inclusion in previous volumes (E. S. R., 29, p. 327).

International catalogue of scientific literature. M—Botany (*Internat. Cat. Sci. Lit., 12 (1915), pp. VIII+835*).—The literature indexed herein is mainly that of 1912 and 1913, but includes also material received too late for insertion in previous issues.

FIELD CROPS.

The influence of relative area in intertilled and other classes of crops on crop yield, D. A. Brodie (*U. S. Dept. Agr., Office Sec. Circ. 57 (1916), pp. 8, fig. 1*).—A report is presented on studies as to the relation of the type of farming to the maintenance of crop yield made in 1914 and 1915 on 240 farms in Chester County, Pa., and on 303 farms in Central Illinios. The labor income was used as the measure of efficiency in producing profits, and the crop index or percentage relation of the crop yields of a particular farm to the average crop yields of all the farms in the community as the measure of efficiency in maintaining crop yield. Use was also made of two other studies furnishing data on this subject, one covering 377 Chester County, Pa., farms, and the other, 300 farms in Lenawee County, Mich. The relation of different groups of crops to crop yield is shown in tables and discussed.

For the purpose of this study the farm crops were divided into intertilled, annual not intertilled, and perennial crops. The results indicated that in all the districts so far studied an optimum percentage of the crop area of the farm may be devoted to a single class of crops and maximum yields maintained. Under the rather intensive types of farming studied in Pennsylvania and Michigan and under the more extensive type practiced in Central Illinois, the optimum area of intertilled crops in each case was found to fall within 5 per cent of each other, the range being about from 32 to 36 per cent. It was further indicated that when more than this percentage of area is devoted to a single class of crops, yields decrease even where there is an increase in the number of live stock per acre.

The area devoted to small grain in the Pennsylvania area is so small that it is regarded as either not directly affecting crop yield or that its influence is completely masked by the effect of the amount of manure available. The optimum percentage area for perennial grass, which is mainly timothy and clover in Chester County, Pa., was about 36 per cent of the crop area of the farm.

A cropping system constructed from data brought out in a survey made in 1912 was found to correspond very closely to the practice of those farmers on the one hand who maintain high yields and with those on the other hand who made the highest profits. Taking the data secured in Chester County, it is stated that with the allowance of about 10 per cent of the crop area of various crops not in the rotation such as garden, orchard, soiling crops, and the like,

there should be in the cropping system about 36 per cent of the crop area in intertilled crops, about 36 per cent in perennial grass, and the remaining 18 per cent in annual crops not intertilled.

Contributions to agronomic terminology, I, C. R. BALL and C. V. PIPER (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 1–9*).—A paper discussing the need and value of a clear and definite terminology in agronomy, and presenting and defining 35 terms relating to the operation of seeding and setting and 88 terms relating to the meadow and pasture industry.

Progressive agriculture, H. W. CAMPBELL (*Lincoln, Nebr.: Author, 1916, pp. 155, figs. 49*).—A popular treatise on the culture of different crops and the methods of soil management in the semi-arid regions of the United States.

Experiments with field crops, C. D. WOODS (*Maine Sta. Bul. 246 (1916), pp. 27, 28*).—In these experiments three uniform ½-acre plats were differently prepared in September, 1912. One plat was plowed and then subsoiled, the second or middle plat was prepared by boring holes 30 to 36 in. deep a rod apart and discharging ½-lb. stick of dynamite in each hole, while the third plat was plowed in the usual way. In 1913, the entire field was planted to potatoes, in 1914 to corn, and in 1915 to rape, the preparation being uniform over the three plats. There were no appreciable differences in the crop on the different plats, and this result is taken as indicating that under the soil conditions at Highmoor Farm no advantage results from the use of dynamite for loosening soil for field crops.

[The Woburn field experiments, 1914], J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 75 (1914), pp. 286–306*).—These experiments are a continuation of work previously noted (E. S. R., 27, p. 831). The year 1914 was the thirty-eighth of the continuous growing of wheat and barley on the same land with the annual or biennial application of different kinds, amounts, and combinations of fertilizers for the different plats. The season was marked by very dry weather from March to harvest time. The yields of wheat were much below the average, those of barley were better, and those of oats were poor.

In the wheat experiment the highest yield, 19.1 bu. per acre, was secured on the plat receiving 3 cwt. of superphosphate, ½ cwt. of sulphate of potash, and 25 lbs. of ammonia in the form of the sulphate. The plat receiving 100 lbs. of ammonia in barnyard manure ranked next with a yield of 11.5 bu., and the one receiving 25 lbs. of ammonia in rape dust stood third with 11.2 bu. per acre. In general the results seemed to indicate that the nitrate of soda plats are failing as a rule and that the land on which this work is conducted is more in need of phosphates than of potash. The barnyard manure plat stood first in the yield of straw with 15 cwt. and 8 lbs. per acre. The results of a variety test were decidedly in favor of Square Head Master as compared with Svalöf and Tystofte, Swedish and Danish wheats, respectively. The use of 4 tons of magnesia per acre apparently gave an increase in the nitrogen content of the wheat but had no influence on the baking quality.

In the barley experiments the barnyard manure plat gave the largest yield, 24.6 bu. per acre, being followed by the plat receiving 3 cwt. of superphosphate and 25 lbs. of ammonia as nitrate of soda per acre with 24.5 bu. The plat receiving 3 cwt. of superphosphate, ½ cwt. of sulphate of potash, and 25 lbs. of ammonia in the form of sulphate per acre, 2 tons of lime having been applied in 1897 and repeated in 1912, ranked third with a yield of 24.3 bu. Sulphate of ammonia used alone or with minerals but without lime gave no crop in any case. A test of varieties showed Tystofte Prentice and Archer about equal in yield and both ranking higher than Svalöf Primus. In quality of grain Tystofte Prentice stood a little higher than Archer.

Mangolds following wheat which had been treated at the rate of 2 tons of magnesia per acre appeared to show a slight residual effect of this application.

In a variety test of oats the Swedish variety Svalöf Victory yielded 37.4 bu. and Banner, a Canadian variety, ranked next with 34.5 bu. per acre. Among four varieties of flax La Plata produced the highest yield of seed. The results of a comparison of Pacey, Dutch, and Italian rye-grass were in favor of Italian rye-grass in two years out of three. A grass mixture with ordinary white clover gave a heavier yield of hay than the same mixture with wild white clover, but the wild white clover proved more promising for pasturage.

A test of varieties of alfalfa resulted in favor of the Russian variety, the Canadian ranking next, with Provence but slightly inferior. American (Arizona) and Turkestan gave the lowest yield.

In grass experiments the best results in improving old pasture were obtained on a plat which had been limed at intervals, the last application having been made in 1909, and which had received superphosphate and sulphate of potash in 1913. Of different kinds of lime, magnesium lime proved the least effective. Ground lime seemed to have given better results than lump lime.

[Field experiments at the Cuttack Experiment Station, 1914–15], G. Sherrard (*Rpt. Dept. Agr. Bihar and Orissa, 1914–15, pp. 45–51*).—Fertilizer and variety tests with rice, and culture and seed selection experiments are briefly described.

The method of transplanting about two rice seedlings 9 or 10 in. apart compared with the practice of transplanting eight or ten seedlings 5 or 6 in. apart gave better yields of grain in each of three years, but the yield of straw was generally in favor of the thicker planting. Experiments undertaken to determine the best rate for broadcasting rice indicated that a saving of from about 18 to 36 lbs. of seed-rice per acre as compared with the general practice can be made without reducing the yields. In the experiment reported, about 27 lbs. of seed-rice per acre on well-prepared ground and omitting the after-plowing gave higher yields of grain in every case than larger quantities of seed per acre together with the customary after-plowing.

In an experiment on the production of jute fiber and rice when grown in rotation in the same year with about 16,000 lbs. of cow manure applied to the jute, an average yield of 843 lbs. of jute fiber and 2,153 lbs. of rice grain and 3,027 lbs. of straw were secured on irrigated land during the four years 1912–1915, inclusive.

[Field experiments], S. N. Sil (*Rpt. Dept. Agr. Bihar and Orissa, 1914–15, pp. 11–29*).—The results of experiments conducted at the Sabour Agricultural College during the year ending June 30, 1915, are reported.

Among other results constant cultivation of fallow during hot weather as compared with no cultivation and the use of about 8,000 lbs. barnyard manure per acre gave increased yields of wheat in every test.

Rice seedlings grown in moist seed beds proved more satisfactory than those produced under dry seed-bed methods. Seedlings two months old when transplanted gave better results than younger or older seedlings. Spacing the plants 6 or 9 in. apart gave much better results than spacing either 12 or 18 in. Green manuring of rice lands for three successive years also proved beneficial. An experiment in which from 1 to 40 rice seedlings were planted per hole showed that 1 or 2 selected and 4 or 6 unselected seedlings per hole appeared to be the economic limit in transplanting. Root-pruning appeared to stimulate the growth of rice seedlings. In a fertilizer test the use in alternate years of about 250 lbs. of bone meal per acre proved more effective than the use of about 415 lbs.

Rahar (*Cajanus indicus*) sown in June produced heavier yields than sowings made in July.

[Field experiments at Dumraon Experiment Station, 1914–15], G. SHERRARD (*Rpt. Dept. Agr. Bihar and Orissa, 1914–15, pp. 38–44*).—The different lines of work pursued during the year are briefly described. The results of manurial tests with rice showed that an annual application of about 400 lbs. of cow manure per acre for 4 years was distinctly profitable as compared with other treatments, and gave better returns even than the use of double the quantity.

[Experiment station work in New South Wales, 1914–15] (*Rpt. Dept. Agr. N. S. Wales, 1915, pp. 132, pls. 12*).—Brief general reports are presented on the experimental work and other activities of the Bathurst, Berry, Coonamble, Cowra, Glen Innes, Grafton, Trangie, Wagga, Wollongbar, and Yanco experiment farms, and a number of demonstration farms. Experiments conducted at Hawkesbury Agricultural College, Lambrigg, and Howlong are also briefly noted.

In a test of 13 varieties of oats at Cowra, a cross between White Ligowo and Algerian ranked first in yield with about 36 bu. per acre, followed by Sunrise producing only a few pounds less. Bathurst No. 4 and Ruakura Rust Resistant also gave promising yields. At the Hawkesbury Agricultural College Cleveland and Warren wheats succeeded best and Ruakura oats was the most rust-resistant and gave the highest yield.

The outstanding feature of the ear-to-row tests in corn-breeding work at the various farms was the variation in yield between the different rows. In every test the highest yielding row produced more than twice as much as the lowest yielding row. It was also found that some of the best yielding rows were almost uniform throughout in type. A cross between Hickory King and Boone County White corn is described as having the small cob and hard, medium-large grain of Hickory King but the deep, wedge-shaped kernels of Boone County White.

In selection experiments at Grafton with Leaming corn the highest yielding row gave 70.2 bu. per acre and the lowest 26.7. The average of 20 ears selected from the crib was 45.5 bu., and the average of 16 field-selected ears 52.1 bu. per acre. No advantage was derived from selecting for two ears per stalk, and ears selected from stalks thick at the base yielded better on an average than those from thin stalks. Ears selected from plants with suckers, especially if these also bore small ears, yielded higher in nearly every case than ears from suckerless stalks. Ears drooping at maturity generally outyielded those erect at maturity. A correlation appeared to exist between medium red color of the kernels and good type of ear.

Results in experiments with Improved Yellow Dent showed that the highest yields were obtained from ears selected from short or medium tall stalks. Ears selected from very tall stalks gave low yields in almost every case, and ears placed low on the stalk gave distinctly higher yields than ears high on the stalk. Ears drooping at maturity yielded 9 per cent higher than erect ears.

Results secured in breeding work with sorghum indicated a correlation of earliness and dwarf stature with grain production, and lateness and tall fodder growth with low seed production. The yield of individual rows ranged from 2¼ to 9½ tons of fodder per acre, and from 1.25 to 29.6 bu. of seed per acre. The best row of a dual purpose strain yielded at the rate of 5.3 tons of fodder and 24.6 bu. of seed per acre.

[Effect of inoculation material on the development of wheat, rye, oats, and barley] (*North Dakota Sta. Rpt. 1915, pt. 1, pp. 15, 16*).—Seed of wheat, oats, rye, and barley was treated with an inoculation material for which it was

claimed that similar results to those secured from the inoculation of the soil for leguminous crops could be obtained. Treated and untreated seed was sown on plats of equal size and condition but no material difference between the plats sown with treated and untreated seed was visible during any part of the growing season. It was concluded that so far as the soil was concerned the application had no value.

Forage crops in central Washington, M. A. McCall (*Washington Sta. Bul. 128 (1916), pp. 3–11, figs. 9*).—Brief notes are given on the results of cooperative trials with forage crops, including corn, sorghum, alfalfa, sweet clover, field peas, rye, and wheat.

Soy bean and cowpea, F. H. Hall (*New York State Sta. Circ. 45 (1915), pp. 6*).—Notes on the general character of these crops, their culture, uses, and value, are presented with special reference to conditions obtaining in the State of New York. It is reported that in 1915 only did the method of planting soy beans and corn together in the same row produce satisfactory growth of soybean forage at the station, and that even then the seeds were far from mature.

Comtesse and Sarah, new French varieties of barley, L. Blaringhem (*Assoc. Franç. Avanc. Sci., Compt. Rend., 43 (1914), pp. 971–974, fig. 1*).—The two varieties of barley described resulted from work entered upon in 1903 for the purpose of improving varieties to meet the requirements of the brewery as well as of the farm. Both varieties belong to the species *Hordeum distichum nutans* and are of pure line breeding. Comtesse yielded from 32.1 to 43.6 bu. per acre in 1912 and from 28.7 to 34.4 bu. in 1913 on soils of medium fertility. The variety Sarah yielded from 37 to 44.5 bu. per acre in the Champagne region and from 40.1 to 43.5 bu. on calcareous soils in the vicinity of Saumur.

Alexandrian clover, A. Carrante (*Agr. Colon [Italy], 9 (1915), Nos. 8, pp. 467–480; 9, pp. 546–556; 10, pp. 583–619; 11, 646–680; 12, pp. 725–756; pls. 19*).—An article discussing the subject under the following heads: Origin and botanical characters, agronomic and biological characters in their relation to the culture of the plant, varieties, culture in Egypt and other countries, climatic and soil requirements, cultivation of the crop, cultivation under irrigation, culture in crop mixtures, utilization of the forage and its feeding value, fertilizing value, adverse conditions and parasites, relation to farm management, and comparison with other leguminous crops.

[Experiments with oats], C. D. Woods (*Maine Sta. Bul. 246 (1916), pp. 4–14*).—A fertilizer test indicated that the phosphoric acid is not a controlling factor in the yield of oats under Aroostook farm conditions.

Fifteen varieties of oats tested at Aroostook Farm in 1915 gave an average yield of 60.1 bu. of grain and 2,285 lbs. of straw per acre. The two leading varieties, Early Pearl and Siberian, yielded 73.7 and 70.6 bu. per acre, respectively, and were the two latest maturing varieties in the list. Kherson, a variety ripening about 10 days before the varieties of medium maturity, ranked third with a yield of 67.6 bu. per acre.

A similar test at Highmoor Farm with 11 commercial varieties resulted in an average yield of 73.9 bu. of grain and 3,384 lbs. of straw per acre. Early Pearl ranked first with 86.6 bu. of grain, Banner second with 83.3 bu., and Minnesota No. 26 third with 81.7 bu. per acre. These varieties have been tested for three years and the average results place Early Pearl first with 84.6 bu., followed by Minnesota No. 26 with 83.5, Gold Rain with 81.2, and Banner with 80.3 bu. per acre.

In a test in 1915 of 12 pure lines of oats originated at Highmoor Farm an average yield of 79.1 bu. of grain and 3,621 lbs. of straw per acre was secured. The leading strains were Maine No. 340 with 82.8 bu., Maine No. 355 with 82.2, Maine No. 281 with 81.3, and Maine No. 247 with 80.2 bu. per acre. The average

results for three years show a yield of 82.8 bu. per acre and a range from 79.9 to 88.5 bu., the strain ranking first being Maine No. 340.

An experiment of seeding oats at the rate of 8, 10, 12, 14, 16, and 20 pk. per acre gave results decidedly in favor of the seeding with 14 pk., and indicated that when the crop is seeded with 3 or 3½ bu. per acre the yield is likely to be as great as when seeded with 4 or 5 bu. The experiment was planned to be repeated in 1916.

Oats in Washington, E. G. Schafer and E. F. Gaines (*Washington Sta. Bul. 129* (*1916*), *pp. 3–13, figs. 3*).—This bulletin describes 16 varieties of oats and reports the results of tests of a list of varieties in the nursery and the field.

Regarding the average yield of all the varieties in the nursery test as 100, the comparative yields ranged from 121.4 for Sparrowbill to 51.5 for Chinese Hulless. In the field tests Abundance, Banner, Swedish Select, and Sixty Day led in yield. Averaging the results of the field and nursery tests the leading varieties, given in decreasing order of yield, were Abundance, Banner, Sparrowbill, Swedish Select, and Sixty Day, all of which gave a yield above the average of the eight varieties in the tests.

[Experiments with potatoes], C. D. Woods (*Maine Sta. Bul. 246* (*1916*), *pp. 16–27*).—An experiment is reported on the effect of omitting potash from the fertilizer application in growing potatoes. The four different mixtures used contained 4 per cent of nitrogen, of which one-third was in the form of nitrate of soda and 8 per cent of available phosphoric acid. The first plat in each of the two series received no potash, the second 2 per cent, the third 5 per cent, and the fourth 8 per cent. In each case the fertilizer was applied at the time of planting at the rate of 1,500 lbs. per acre. The average yield on the two plats receiving no potash was 302 bu. as compared with 320 bu. on the plats receiving 2 per cent, 320 bu. on those receiving 5 per cent, and 331 bu. on those receiving 8 per cent of potash. It is concluded that while the results from the use of the larger amounts of potash indicate that potash may be expected to increase the yield of potatoes in Aroostook County, they also indicate that a profitable yield can be obtained without its addition for at least one year.

In a comparison of different methods of applying the fertilizer in potato culture at Aroostook Farm, 1,500 lbs. per acre was used of a fertilizer carrying 4 per cent nitrogen, 8 per cent available phosphoric acid, and 7 per cent water-soluble potash. One-third of the nitrogen was in the form of nitrate of soda and the remainder was high-grade organic nitrogen. The entire quantity was applied in the planter or broadcast, or 1,000 lbs. was applied in the planter or broadcast and 500 lbs. given when the crop was up. The average results of two years show that there is little to choose between the methods compared, and the experiment is to be repeated for further data.

In a comparison of sulphate of ammonia and nitrate of soda as a source of nitrogen in potato fertilizers, the results for two years show that the sulphate of ammonia plats gave somewhat larger yields than the nitrate of soda plats. The organic nitrogen did not appear to be as completely available as the two other forms.

The culture of the peanut, J. M. de Souza (*Rio de Janeiro: Min. Agr. Indus. e Com., 1915, pp. 3–13*).—The culture of the peanut and its uses are briefly described, and in this connection notes are given on the origin, history, synonomy, geographical distribution, and climatic requirements of the plant.

The botanical origin of the cultivated varieties of rice, O. Roehrich (*Assoc. Franç. Avanc. Sci., Compt. Rend., 43* (*1914*), *pp. 479–487*).—Historical notes on the development and distribution of rice culture are given, together with botanical descriptions of *Oriza latifolia*, *O. brachyantha*, *O. breviligulata*, *O. longistaminata*, and *O. sativa*.

Varieties of soy beans, F. A. WELTON (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 99–101*).—Notes are given on the culture of soy beans and the results of a 4-year test of 25 varieties are tabulated.

Of 6 early varieties or those ripening on or before September 27, Chestnut and Ito San 17268 had an average yield exceeding 27 bu. per acre. The best yielding varieties in the list with an average yield above 28 bu. per acre were Ohio 7486, Ohio 9016, and Ohio 9110, varieties maturing from September 28 to October 6. Of the late varieties or those maturing on or after October 7, Ohio 7491 and Ohio 9035 ranked highest with 26.28 and 25.58 bu. per acre, respectively. For the production of hay, Cloud, Ohio 9035, Sable, Taha, Auburn, Ebony, Medium Green, and Shingto, and for silage, varieties of the type of the Medium Green gave promising results. Plans for cooperative work in testing promising strains isolated by the station are briefly outlined.

Variety tests with sugar beets (*Ztschr. Zuckerindus. Böhmen, 40 (1916), No. 4, pp. 155–170*).—These tests were conducted in triplicate at each of four different points by the sugar industry association of Bohemia, and the samples studied were made up of 50 beets from each plat.

The average yields of varieties grown in 1915 were as follows: Dippe 33,995, Zapotil 33,549, Schreiber 33,665, Dobrovic 33,585, Rabbethge and Giesecke 33,290, Kuhn 36,048, Mandelik 33,133, and Dobrovic "average," which differed from Dobrovic only in the seed sample, which was made up by the growers from seed grown in their several fields, 33,754 lbs. per acre. The corresponding sugar contents were 19.53, 19.54, 19.31, 20.02, 19.51, 19.37, 19.58, and 19.94 per cent.

A comparative study of the weeds of central Iowa, northern Minnesota, and Wisconsin, L. H. PAMMEL (*Proc. Iowa Acad. Sci., 22 (1915), pp. 57–59*).—A table is given showing the occurrence or nonocurrence of a list of weeds at Ames, Iowa; St. Paul, Brainerd, Cass Lake, and Duluth, Minn.; or St. Croix Falls, Wis.

[Eradication of quack grass] (*North Dakota Sta. Rpt. 1915, pt. 1, p. 16*).—Flake potash was applied in different amounts up to 16,000 lbs. per acre in direct contact with the grass. The heaviest application seemed strong enough to kill the quack grass on the surface of the ground, but it did not prevent the final growth of the grass from the lower root stalks.

HORTICULTURE.

[Report of horticultural investigations] (*Georgia Sta. Rpt. 1915, pp. 9–12*).—A brief statement of progress made in various horticultural projects, under the direction of H. P. Stuckey, during the year.

In breeding work with tomatoes it was found that first and second generation plants from the crosses between the red cherry tomato and Greater Baltimore, a large commercial variety, gave fruit resistant to the blossom-end rot and in size intermediate between the fruit of the two parents. Plants resulting from seed taken from diseased tomatoes of the Globe variety produced fruit more susceptible to blossom-end rot than did plants grown from seed taken from sound fruit.

A selection from the third generation progeny of a cross between the Georgia collard and the Charlestown Wakefield cabbage has given a stocky, compact plant, intermediate between the parent types and apparently resistant to disease.

In the spring of 1912 one acre was set to apple trees, every other row being stock infected with crown gall and every other row being set to sound stock. Measurements at the end of the season 1915 show that the sound stock

had made a little better growth than the crown-gall infected stock. A collection of varieties of pears was set out in the spring of 1912 to determine the influence of fertilizers and cultural methods on the development and spread of the pear blight. Of these varieties a pear of the Garber type, belonging to the *Pyrus sinensis* group and secured from the eastern section of South Carolina, was found to be practically immune to the blight. This pear is slightly superior to the Kieffer in quality.

Observations made on the flowers of a number of Elberta peach seedlings confirmed previous observations reported by Hedrick (E. S. R., 29, p. 424) with reference to the relation of the color of the inside of the corolla cup and the color of the flesh of the peach. Deep orange corolla cups gave yellow flesh peaches; light yellow or green corolla cups gave green or white flesh peaches.

An investigation of the cause of partial or entire self-sterility existing among certain varieties of pecans has shown that the varieties can be divided into two distinct groups based on the floral character of the catkins of the staminate flowers. The two most important differences between these two groups from an economic standpoint are the difference in the viability of the pollen and the difference between the time the pollen is shed and the time the pistillate flower becomes receptive. The pollen of one group was found to be approximately three times as viable as that of the other group and the pollen was shed at approximately the same time that the pistillate flowers became receptive. In the other group the difference in time between the shedding of the pollen and the receptive stage of the pistillate flower ranged from 6 to 13 days. These observations indicate that a certain number of early blooming varieties should be interplanted with those varieties in which the pollen is late in developing.

A large number of crosses between the black and white fruiting varieties of Rotundifolia grapes showed that black is dominant to white and that white is a pure recessive, thus indicating that white or light fruiting vines may be produced by pollinating the flowers of Scuppernong vines with pollen from white male vines. Studies thus far made of the microspore development of *Vitis rotundifolia* in order to ascertain the cause of self-sterility in these grapes have shown that the microspores functioned normally in both male and female through the tetrad stage. Following this stage the pollen from the self-sterile varieties shows signs of degeneration.

A B C of vegetable gardening, E. E. Rexford (*New York and London: Harper & Bros., 1916, pp. 116*).—A popular treatise on the culture of vegetables and small fruits.

Spraying programs for the small home orchard and fruit garden, H. A. Gossard and W. J. Green (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 103–107*).—This comprises abridged spraying programs for the treatment of orchard and small fruits. The programs are prepared with special reference to the owners of small orchards.

Spray formulas for the town lot, P. Thayer (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 114–116*).—The author has here perfected a set of spray formulas adapted for use in the small fruit garden where only a few trees and bushes are to be sprayed. Wherever possible measures are given permitting of the ready preparation of small amounts of spray materials.

Culture of cabbage, J. W. Wellington (*New York State Sta. Circ. 48 (1916), pp. 5*).—This circular contains concise directions for growing cabbage, including instructions for the control of diseases and insect pests and a list of the more important varieties.

New or noteworthy fruits, IV, U. P. Hedrick (*New York State Sta. Bul. 414 (1916), pp. 3–10, pls. 5*).—In continuation of a previous bulletin (E. S. R., 33, p. 238) the author describes the best recent fruit introductions as tested

on the station grounds. The varieties here described include the Perfect apple, Rochester peach, Reine Hortense cherry, the Empire State grape, and Herbert raspberry.

Fifteenth report of the Woburn Experimental Fruit Farm, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt., 15 (1916), pp. 83*).—This comprises a progress report on a number of long-continued investigations with fruit trees and shrubs and other trees.

Among other points being investigated, it has been sought to determine whether apple trees have a tendency to produce alternate light and heavy crops. One experiment favoring alternate cropping was recorded in a previous report (E. S. R., 17, p. 559). Subsequent experiments have led to the conclusion that the tendency toward alternate cropping is very feeble and that there is at the same time an equally potent tendency to consecutive cropping, that is, a tree bearing particularly well or badly during one season will probably do the same in the succeeding season. It is believed that the chief factor in determining good or poor bearing is the atmospheric conditions rather than any innate tendency of the individual tree to either alternate or consecutive fruiting. In the experiments conducted at Woburn the principal factor influencing bearing has been spring frosts.

Several series of experiments were made to ascertain the distribution of new rootlets forming on trees after transplantation. In the case of apples less than half of the new rootlets originated within the last half inch of the old roots which had been trimmed before planting, whereas with currants and gooseberries more than half originated from this half inch. Roots originating from the stems were found to be on the average 20 per cent greater in stoutness than that of roots forming elsewhere. This result explains the habit of deeply planted free-rooting stocks of flourishing better after a time than similar stocks planted at the ordinary depth. With reference to the effect of trimming the roots of the tree at the time of transplanting on the subsequent formation of new roots, the results showed considerable variation in different seasons and with different plants. The general conclusion is reached that trimming is of no importance.

Further tests of orthodox and careless methods of planting trees (E. S. R., 20, p. 1034) have continued to show no bad effects. In the case of two series of experiments in which the ground was rammed around the trees after the trees were planted the advantage gained by this procedure persisted throughout the succeeding seven or eight years. In one instance, however, where the trees were planted in a type of clay unsuited for fruit culture ramming proved to be very deleterious, the soil around the roots developing sulphuretted hydrogen owing to the absence of aeration. Ramming experiments conducted with 1,400 forest trees of various sorts resulted in only a slightly greater growth for the rammed trees, but the subsequent mortality among the rammed trees was only half as great as among those not rammed.

Experiments were undertaken to ascertain whether apple trees in a heavy soil suffered less from canker if they were planted higher than usual. Certain varieties subject to this disease were planted at the usual depth and also with their roots flush with the surface of the ground. Observations over a period of ten years show that the high-planted trees have not flourished quite so well as the others. No relation between their behavior in successive years and the rainfall was observed. The high-planted trees have suffered somewhat less from the attack of canker.

Experiments dealing with the cutting back of the branches of trees at the time of transplanting have shown that such cutting back may be delayed up to any time before active growth begins without any injury to the trees.

If delayed until the summer the effect is very deleterious and remains in evidence for many years afterwards. If the operation can not be done before summer, it is recommended that it be deferred until the succeeding winter. When this cutting back is deferred to the end of the first year and is followed by excessive root growth very strong branch growth subsequently occurs, at least during one season. The tree often continues this growth and does not come into proper bearing until several years later than similar trees which have been cut back at the time of transplanting.

Evidence was obtained as to the importance of trees being exposed as little as possible during the removal from the nursery to the plantation. Trees which were left in a shed for four days after being lifted and before being planted suffered to the extent of about 50 per cent in their subsequent growth. The authors attribute the less satisfactory results from spring planting as compared to early winter planting to the exposure to the more prevalent drying winds in the spring.

Experiments dealing with the effect of branch pruning on fruit production were continued (E. S. R., 19, p. 142), the results previously noted being confirmed and extended. The results show in general that to secure the heaviest crops the pruning should be just sufficient to develop healthy, well-formed trees.

Winter washes tried at Wisley, 1914–15, H. M. Lefroy (*Jour. Roy. Hort. Soc., 41* (*1915*), *No. 2, pp. 230–233*).—The author reports tests of a number of winter washes used on apple and plum trees. The washes were studied with special reference to solubility in or miscibility with water, corrosiveness as affecting the rubber tubing, etc., effect on workers or their clothes, wetting power, cost, and general effectiveness of the wash.

Experiment in setting apple trees, C. D. Woods (*Maine Sta. Bul. 246* (*1916*), *pp. 28–30*).—A number of Baldwin apple trees were planted in 1913, part of the trees being set in the usual way by digging holes in the spring with a spade. The remainder of the trees were planted in the spring in soil that had been loosened with dynamite the previous fall. Practically no difference in growth was observed between the two lots of trees in 1913 and in 1914. In the spring of 1915, however, it was found that about 39 per cent of the trees planted in the holes previously dynamited were either winterkilled or badly injured as compared with only 8 per cent of those planted in the usual way. No general conclusion is drawn from these data. For the soil in question, however, which is a moderately heavy, reddish loam underlain with a very difficultly penetrable subsoil, it appears that dynamiting is of no value in setting trees.

Fertilizer experiments on apple trees at Highmoor Farm, C. D. Woods (*Maine Sta. Bul. 246* (*1916*), *pp. 2–4*).—In connection with some fertilizer experiments with apple trees conducted at the Highmoor Farm for several years a test is being made of highly nitrogenous fertilizers as a means of forcing trees into bearing. Each year the orchards as a whole have received a commercial fertilizer carrying 4 per cent nitrogen, 8 per cent available phosphoric acid, and 7 per cent potash at the rate of 1,000 lbs. per acre. In the excess nitrogen plats the trees have received in addition nitrate of soda at the rate of 100 lbs. per acre. Thus far no differences that could be attributed to the additional nitrogen in the fertilizers have been noticed.

An experiment was begun in 1912 with some 400 trees which had received all the above noted fertilizer treatment for three years. The trees were divided into 3 plats, one of which received no fertilizer, the second 500 lbs. per acre annually of the 4:8:7 formula, and the third of which received 1,000 lbs. per acre of the 4:8:7 formula. Observations to date failed to show any differences even in appearance between the fully fertilized, partially fertilized, and unfertilized trees. The actual yields in fruit, however, in 1914 and in 1915,

which were fair crop years, were larger on the fertilized plats. The yields for 1915 showed an increase consistent with the amount of fertilizer used.

The experiment is to be continued for a number of years before definite conclusions are drawn.

Field experiments in spraying apple orchards, B. S. PICKETT ET AL. (*Illinois Sta. Bul. 185* (*1916*), *pp. 49–212, figs. 22*).—This bulletin comprises reports on a number of field experiments conducted in the leading orchard sections of Illinois. The experiments were undertaken for the purpose of coordinating the results of earlier investigations into general systems of spraying, the attempt being made to evolve methods of practice which would be practical from a commercial standpoint. The following work is reported: Spraying experiments in 1910, 1911, and 1912 at Neoga, Cumberland County, by O. S. Watkins (pp. 58–103); spraying experiments in 1912 at Flora, Clay County, by W. A. Ruth (pp. 104–117); spraying experiments in 1909 at Griggsville, Pike County, in 1910 and in 1911 at Centralia, Marion County, and in 1912 at Anna, Union County, by L. E. Foglesong (pp. 118–155); spraying experiments in 1911 and in 1912 at Griggsville, Pike County, by A. J. Gunderson (pp. 156–186). The results secured in each investigation are summarized. An introductory account of the scope and methods of conducting the experiments (pp. 49–57), together with a general summary of the work as a whole, including recommendations for spraying practice in Illinois apple orchards (pp. 187–212) are given by B. S. Pickett.

The experiments as a whole have shown the general effectiveness of applications of standard spray mixtures, including Bordeaux, lime-sulphur, and arsenate of lead in the control of fungi and insects of the apple. Both Bordeaux and lime-sulphur properly used were excellent sprays for the apple. Bordeaux gave greater efficiency as a fungicide but also showed serious tendencies to injure fruit and foilage. Lime-sulphur exercised a fair degree of control of fungi and caused little damage to fruit or foilage. Bordeaux is especially recommended where fungus diseases are known to be serious and also for the cluster bud spray since it seldom injures either fruit or foliage at this stage. In orchards previously cared for the authors advise the use of lime-sulphur for the spray which follows the fall of the petals and for the third summer spray which follows from a week to ten days after the fall of the petals.

Experiments were undertaken to determine whether Bordeaux injury can be lessened or prevented by covering the first spray with a secondary spray of Bordeaux or by maintaining over the Bordeaux a coating of lime throughout the season. Some beneficial effects were observed in certain of the experiments but the work as a whole gave no marked results.

Self-boiled lime-sulphur proved inferior to lime-sulphur made in the usual way as a fungicide although it appeared to exert some stimulating or beneficial effect on the health and vigor of the foliage. Owing to its worthlessness in the control of apple scab it is not recommended as a successful spray for the apple. The addition of copper sulphate to lime-sulphur did not add to its usefulness as a spray. In three of the experiments reported on it resulted in more or less severe injury to the fruit. An application of lime-sulphur made at the strength used for San José scale applied while the trees were dormant was of no value as a preventive of apple scab. Paris green proved less effective than arsenate of lead when used in combination with standard fungicides for the control of chewing insects, particularly the codling moth and the plum curculio, and caused considerable foliage injury.

Arsenate of lead alone possessed practically no fungicidal value and it is recommended that it never be used except in combination with a fungicide.

The addition of arsenate of lead to lime-sulphur appears to increase the fungicidal value of the resulting spray, but its addition to Bordeaux does not increase the fungicidal value of the mixture. In combination with lime-sulphur solution the neutral arsenate of lead produced a spray which was more efficient and safer to use than those arsenates of lead higher in arsenic oxid. The various classes of arsenate of lead when used in combination with Bordeaux showed no important differences in the control of diseases, insects, or injuries to the fruit.

A number of new sprays were tested both as fungicides and as insecticides. Among these it is believed that copper ferrocyanid is worthy of further investigation as a fungicide. The results thus far obtained do not warrant its use except in an experimental way. Copper ferrocyanid failed to show any decided qualities as a poison spray.

With reference to the application of summer sprays in general the work as a whole shows that the first three summer sprays are most useful in improving the grade and quality of the fruit by controlling the majority of the insects and fungi. None of these sprays can be omitted safely. The addition of the fourth and fifth sprays assisted in controlling late-brood codling moth and injury from curculio. A thin but complete coating of the fruit and foliage with Bordeaux-arsenate of lead is more desirable than a heavy coat, except in cases where special protection from curculio is necessary.

Varieties of apples in Ohio, W. J. Green, P. Thayer, and J. B. Keil (*Ohio Sta. Bul. 290 (1915), pp. 31–184, figs. 22*).—This bulletin contains full horticultural descriptions of the important new or little-known varieties of apples, together with briefer descriptions of the well-known varieties and those of minor importance.

A table showing the disease susceptibility of varieties of apples, prepared by A. D. Selby and others, is given, together with tables showing the adaptation of varieties to sections of Ohio and the quality in different varieties of apples for specific uses.

Water-core of the King David apple, J. B. Keil (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 117, 118, fig. 1*).—In this article the author briefly discusses the tendency of certain varieties of apples to form water-core through the accumulation of excess sap in the tissues surrounding the fibro-vascular bundles or core lines. Preliminary tests of a number of varieties including the Winesap, Delicious, Kinnard, and Stayman Winesap indicate that where the water-core is not too severe the excess of sap is again distributed to the surrounding tissues in the ripening process. Recovery seems to be less prevalent in King David than in any other variety tested, the water-core specimens becoming inedible and subject to early decay.

The results of storage tests with King David conducted in 1914 and in 1915 indicate that if this variety is picked with a moderately good color before the water-core develops it may remain either in cold storge or cellar storage for several months without developing water-core. In the tests here reported apples stored about October 12 developed no water-core in storage, whereas with apples stored on October 23 an average of only 31 per cent of the apples was free from water-core.

Peach precooling, E. Smith (*Agr. Gaz. Canada, 3 (1916), No. 2, pp. 121–123, figs. 2*).—In some experiments conducted by the Canadian Department of Agriculture precooled peaches were placed in two experimental cars which were iced with crushed ice and 5 per cent of salt in place of block ice without salt, as is the ordinary practice of icing. The results were satisfactory, the temperatures ranging from 30 to 40° F. during an 8-day trip, thus giving better temperatures than are ordinarily secured in block ice cars. There was no evidence of

damage from lower temperatures near the tanks. The cars required a very small amount of ice during transit.

A refrigerator car loaded with precooled fruit showed a rapid cooling down at the beginning of the trip as compared with a slow rate of cooling in a refrigerator car loaded with fruit not precooled.

Pruning the bearing prune tree, V. R. GARDNER (*Better Fruit, 10 (1916), No. 9, pp. 9–11, figs. 6*).—A discussion of pruning with special reference to the maintenance and proper distribution of fruit spurs in bearing prune trees.

Gooseberries, O. M. TAYLOR (*New York State Sta. Circ. 46 (1915), pp. 5*).—Concise directions are given for growing gooseberries, including information relative to the control of insects and diseases and varieties.

Winter protection of the Vinifera grape, F. GARCIA and J. W. RIGNEY (*New Mexico Sta. Bul. 100 (1916), pp. 32, figs. 10*).—This bulletin describes experiments started in 1906 to determine, among other things, the effect of winter protection upon the vines and yield of five varieties of Vinifera grapes.

Summing up the results for several seasons it was found that the simple banking up of the dirt around the vines protected them during the winter and that the yields were very satisfactory. Unprotected vines were winter injured every time, except once, when there was considerable rainfall during the winter. With reference to resistance to winter temperatures Muscat of Alexandria and New Mexico Mission were most resistant, followed by the Black Cornichon variety. The Emperor and Flame Tokay varieties were slightly less hardy than the Black Cornichon.

Irrigating the vines alone without covering them did not prevent winter injury. Vines that were irrigated either before or right after covering showed no material advantage over those covered and not irrigated, but irrigation either before or after covering did not make the vines any more susceptible to winter injury, and irrigating just before covering makes the plowing of the soil and the banking of the vines easier.

Directions are given for banking up and uncovering the vines. The observations indicate that it is a good plan to uncover the vines from two to four weeks before the pruning takes place, which, at the station, is usually done the first week in April. If the vines are left covered too long the base buds are apt to grow and be injured, either in pruning or uncovering. The two or three weeks difference in time of covering did not show any material influence on the yield. In general it is recommended that the vines be covered from two to three weeks after the first frost.

The hybrid direct bearers in the valley of the Rhone in 1915, A. DESMOULINS and V. VILLARD (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), Nos. 10, pp. 228, 229; 11, pp. 258–260; 12, pp. 274–279; 13, pp. 306–311*).—This is the usual progress report (E. S. R., 34, p. 234) relative to the behavior of a large number of hybrid direct bearing grapes, with special reference to their resistance to disease and drought and their adaptation to various soil conditions.

The two groups of varieties of the Hicora pecan and their relation to self-sterility, H. P. STUCKEY (*Proc. Soc. Hort. Sci., 12 (1915), pp. 41–44*).—A report of investigations conducted at the Georgia Experiment Station, the results of which are summarized above.

Dahlias and their culture, F. H. HALL (*New York State Sta. Circ. 43 (1915), pp. 23, pls. 8*).—In this circular the author gives a brief history of dahlias, together with the classification of dahlias as recently adopted by the American Dahlia Society, and descriptive lists of various types of dahlias considered worthy of recommendation for general culture. Concise directions for the culture and care of dahlias are also included.

A street tree system for New York City, Borough of Manhattan, L. D. Cox (*N. Y. State Col. Forestry, Syracuse Univ. [Pubs.], 16 (1916), No. 8, pp. 89, pls. 3, figs. 33*).—This bulletin comprises a report to the park commissioner for the boroughs of Manhattan and Richmond, and embodies the results of the author's investigation concerning the possibilities for successful tree growth in the Borough of Manhattan.

The subject matter is discussed under the following general headings: The street tree problem in Manhattan, the street tree system, planting types, spacing and arrangement, what trees to plant, how to plant, the cost of planting, organization and budget, the street tree census, and street tree planting in Richmond. A plan showing a proposed system of street planting for the Borough of Manhattan is appended.

The making of a home, E. E. Rexford (*Philadelphia: George W. Jacobs & Co., 1916, pp. 313, pls. 8*).—A popular treatise on ornamental gardening.

FORESTRY.

Forest legislation in America prior to March 4, 1789, J. P. Kinney (*New York Cornell Sta. Bul. 370 (1916), pp. 361–405*).—This bulletin comprises part of a study presented for the degree of master of forestry at Cornell University.

The bulletin discusses early legislation in the colonies regarding forest fires, the conservation of timber and the prevention of trespass, regulation of the lumber and timber industry, British legislation directed toward the control of forest industries in the colonies, and special developments in forest law during the 50 years preceding the formation of the Union.

A bibliography of consulted literature is appended.

Forest provisions of New York State constitution, C. R. Pettis (*Forestry Quart., 14 (1916), No. 1, pp. 50–60*).—This paper discusses forest activities in New York State in relation to various forest provisions of the constitution. The text of the conservation amendment proposed by the constitutional convention in 1915 is also given and discussed.

The fire wardens' manual (*N. H. Forestry Com. Bul. 5, rev. (1916), pp. 88, figs. 2*).—This bulletin contains the laws of New Hampshire relating to forest protection and instruction to forest fire wardens, lookout watchmen, patrolmen, and others connected with the forest fire service.

The Algerian forest code, T. S. Woolsey, Jr. (*Forestry Quart., 14 (1916), No. 1, pp. 66–80*).—The present forest code of Algeria, which has been in force since 1903, is here given and discussed.

Eighth report of the state forester, 1915, W. O. Filley and A. E. Moss (*Connecticut State Sta. Rpt. 1915, pt. 3, pp. 193–232, pls. 2*).—This report covers the work of 1914 and 1915, and includes the results of a forest survey of the State of Connecticut completed in 1914 and data showing the forest fires in Connecticut during 1914 and 1915. Forest conditions in the different counties of the State are discussed and a detailed table of forest areas by town and county is given, as well as maps showing the percentage of forest land in Connecticut towns and the regions containing the most extensive forest areas in the State. An area of 1,482,700 acres or 46.4 per cent of the area of the State is found to be wooded.

[Report on Indiana Forest Reserve for 1915], E. A. Gladden (*Ann. Rpt. Ind. Bd. Forestry, 15 (1915), pp. 14–57, figs. 9*).—This report consists in the main of a statement of progress made on some 80 forest tracts in the reserve (E. S. R., 33, p. 144).

Twelfth annual report of the state forester [of Massachusetts], F. W. Rane (*Ann. Rpt. State Forester Mass., 12 (1915), pp. 130, pls. 8*).—This is the usual

annual report relative to the administration and management of the state nurseries and forests in Massachusetts, including also accounts of reforestation work, private cooperative forestry work, and fire protection work. Information is also given relative to the present status of the chestnut blight and white pine blister rust and the work of suppressing the gipsy and browntail moths.

Present conditions of applied forestry in Canada, H. R. MacMillan (*Quart. Jour. Forestry, 10 (1916), No. 2, pp. 105–123*).—An account of the forest policy in the different Provinces of Canada and its effect on practical forestry.

Silvicultural problems of Canadian forest reserves, B. E. Fernow (*Forestry Quart., 14 (1916), No. 1, pp. 14–23*).—A paper on this subject presented to the Commission of Conservation of Canada, Ottawa, 1916. The subject matter embraces the results of an inspection made to formulate propositions for investigatory work as a basis for an eventual technical management of the reserves.

Forest pathology in forest regulation, E. P. Meinecke (*U. S. Dept. Agr. Bul. 275 (1916), pp. 63*).—This bulletin comprises a study of the pathology of some white fir stands located on the Crater National Forest in southwestern Oregon. The purpose of the present study is to show by means of one example the problems in forest pathology as related to forest regulation and to furnish some data for the development of laws leading to the regulation of forests, with special reference to the production of sound timber.

Regulation of yield is discussed at some length, consideration being given to working plans, rotation, the cutting cycle, cumulative risk, period of transition, condition of timber stock, total loss, and inferior species. The author's methods of investigation are described in detail and a short review of our present knowledge of the plant pathology of white fir is included. The results of the investigation are discussed under the general headings of decay in relation to wounds, care of virgin forests, forest regulation through timber sales, marking, and pathological rotation and cutting cycles.

Abnormal wood in conifers, W. Somerville (*Quart. Jour. Forestry, 10 (1916), No. 2, pp. 132–136, pls. 2*).—The author here describes and illustrates a form of wood injury occurring in a number of species of young conifers in the early spring wood of the growth of 1912. The injury is attributed to the excessive heat and drought during the summer of 1911.

The costs and values of forest protection, P. S. Lovejoy (*Forestry Quart., 14 (1916), No. 1, pp. 24–38*).—A discussion of forest protection results on the National Forests and in other countries, with special reference to the status of fire protection as a business proposition. The author concludes that the forest business can fully justify the costs of adequate protection, which will probably approximate 20 cts. per acre per year, of which perhaps 10 cts. will be chargeable to fire protection.

Concerning site, F. Roth (*Forestry Quart., 14 (1916), No. 1, pp. 3–13*).—A discussion of the importance of site classification as applied to forestry, together with suggestions relative to a basis for such classification.

In an addendum to this paper by H. A. Parker (pp. 12, 13) data are given showing the close relationship of height and volume to site among the pines.

The theory and practice of mixing trees, A. T. Gillanders (*Quart. Jour. Forestry, 10 (1916), No. 2, pp. 87–104*).—This article deals largely with combinations of trees suitable for establishing young forest plantations. Brief reference is also made to ameliorative mixtures and deferred mixtures.

Trees for Kansas, C. A. Scott (*Kansas Sta. Circ. 55 (1916), pp. 19, figs. 9*).—Lists are given of trees and native shrubs suited to different sections and soils in Kansas, together with general directions for the planting and care of trees.

Data are also given showing the results secured from trees sent out by the state nursery during four seasons.

The junipers and their commercial importance, W. Dallimore (*Roy. Bot. Gard. Kew, Bul. Misc. Inform., No. 1 (1916), pp. 16–23*).—Descriptive notes dealing with cedar woods in a previous article (E. S. R., 29, p. 842) are here extended, and descriptions are given of other species of juniper not so well known commercially as cedar.

Rattan supply of the Philippines, J. R. Arnold (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 95 (1915), pp. 40*).—A statistical report on the supply of Philippine rattan and its suitability as to quality, cost of exploitation, etc., for placing in quantities on the export market.

Wood-using industries of West Virginia, compiled by J. C. Nellis and J. T. Harris (*W. Va. Dept. Agr. Bul. 10 (1915), pp. 144*).—This embraces the results of a study of the wood-using industries of West Virginia, conducted cooperatively by the Forest Service of the U. S. Department of Agriculture and the State of West Virginia. Information is given relative to the principal woods of the State; the kinds and amounts of woods used in the industries, including those grown in the State and out of the State; and the uses of the various woods.

By-products of the lumber industry, H. K. Benson (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 110 (1916), pp. 68, pl. 1, figs. 10*).—This bulletin embraces the results of a survey relative to the utilization of the by-products of the lumber industry in the United States. Consideration is given to the utilization of wood in the wood-distillation industries, pulp manufacture, and tannin-extract manufacture. The other industries discussed are the manufacture of ethyl alcohol, producer gas, oxalic acid, plastics, and needle oils. A general account is given of methods and processes employed, together with data showing the extent of the industries.

An efficient system for computing timber estimates, C. E. Dunston and C. R. Garvey (*Forestry Quart., 14 (1916), No. 1, pp. 1, 2, pl. 1*).—A simple device for holding timber estimate sheets and volume tables when computing estimates on adding machines is here illustrated and described.

DISEASES OF PLANTS.

Work connected with insect and fungus pests and their control, W. Robson (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Montserrat, 1914–15, pp. 18–20*).—The staining of cotton is thought to be due to some organism not yet identified which is given entrance by the stainer insect when it pierces the boll in order to extract the juices from the seed. A number of other injurious insects are reported upon.

Experiments with Bordeaux mixture for control of leaf rust of peanuts (*Uredo* sp.) resulted in an increase of yield. This outcome was in contrast with that of two previous tests, which were, however, made later in the season.

Puccinia maydis, not previously recorded here, was noted as general in one field. A field of young maize plants to leeward of an old infected field showed pustules of the fungus three weeks after the time of its planting.

Tephrosia candida was attacked by *Neocosmospora vasinfecta*.

Flower heads of imphee (sorghum) were reported to be attacked by *Sphacelotheca sorghi*. The formalin treatment (1 lb. to 30 gal. water) is said to be convenient and safely preventive.

Damping off of onion seedlings in the seed bed, caused by a fungus or fungi, is said to be prevented by thoroughly heating the soil for some time or by use

of formalin (1 part to 50 of water), or by a layer of sand on the surface of the seed bed.

A lace bark tree (*Lagetta lintearia*) was killed by *Lasiodiplodia theobromæ*, said to be a common cause of injury to cacao and other trees.

The ornamental plant *Plumbago rosea* was attacked and injured by nematodes, which may also be the cause of swellings on Echiums.

Mycological and pathological notes, M. TURCONI and L. MAFFEI (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 12 (1915), pp. 329–336, pl. 1*).—The authors describe as having been found on leaves of ash received from Mexico, *Cercospora lumbricoides*, n. sp.; on a branch of *Castilloa elastica* from the same source, *Nectria castilloæ* n. sp.; and on twigs of mulberry from Bulgaria, *Steganosporium kosaroffii* n. sp.

Review of plant diseases, G. SCALIA (*Bol. Min. Agr., Indus. e Com. [Rome], Ser. B, 14 (1915), I, No. 2, pp. 52–63*).—This is a condensed review of cryptogamic diseases, animal parasites, etc., of plants as studied in the laboratory for vegetable pathology in the school of enology at Catania, during 1910–1913.

Annual report of the government botanist for 1914–15, W. SMALL (*Ann. Rpt. Dept. Agr. Uganda, 1915, pp. 57–70*).—Coffee leaf disease (*Hemileia vastatrix*) is reported as having decreased since 1913, apparently of its own accord. Spraying is recommended as a preventive, especially in case of young estates.

Coffee dieback, in so far as it has not been due to attack by Hemileia, is regarded as the direct effect of a form of overbearing by the branches intermediate between the basal and apical regions. The remedy consists in cutting away all the part above the early branches and reproducing the top by means of a new sucker from the stump, also in relieving the intermediate branches of their heavy first crop. Good cultivation is a necessity. Of the fungi noted in this connection none appears to be constantly present.

Brown root disease of coffee, due to *Hymenochæte noxia*, has usually been traced to a dead stump or log, frequently of unknown species. The mycelium, however, can not make its way through the soil, so that only the older trees are attacked.

Sooty mold of coffee, due to *Capnodium brasiliense*, is checked by killing the insects which it follows with a spray of whale oil soap solution. An anomaly in the flowering of Uganda coffee was noted in which no pollen was shed, owing to nondehiscence of the anthers.

Cacao was very little diseased. A dieback was attributed to a fungus showing, apparently, the Diplodia spores of *Thyridaria tarda*. These are thought to cause also a dieback of Hevea, and in part at least a pod disease of cacao which in other cases was associated with *Colletotrichum incarnatum* and later with *Phytophthora faberi*. A root disease of cacao is described which is thought to have had its origin in native plants previously cultivated.

Hevea also showed few diseases, *Hymenochæte noxia* being the only root disease as yet certainly identified. A dieback was associated with *T. tarda*, *Phyllosticta ramicola*, and *Phoma heveæ*, but not with *Glœosporium alborubrum*, previously noted in this connection. Hevea canker has not been reported.

Ceara rubber (*Manihot glaziovii*) is often attacked and ruined by *Loranthus entebbensis*.

Cotton is free from fungus disease except in case of *Ramularia areola*, which is confined chiefly to young plants, the leaves of which are attacked, usually not very severely. Wheat in some sections is attacked by *Puccinia graminis*. Maize is attacked by head smut (*Sorosporium reilianum*), which is not known to have been reported previously in Uganda.

Mention is made of several other fungi known to attack various wild or cultivated plants in Uganda.

An anatomical study of Gymnosporangium galls, A. STEWART (*Amer. Jour. Bot., 2 (1915), No. 8, pp. 402–417, pls. 2, fig. 1*).—The author states that the large galls which *G. juniperi-virginianæ* and *G. globosum* cause on the younger branches of *Juniperus virginiana* arise from the axils of the leaves, being evidently transformed axillary buds. They are said to have two distinct fibrovascular systems, one of which is a leaf-trace system and the other a stem which, in case of the older galls, gradually breaks up and radiates outwardly still deeper into the gall tissue. Leaf tissue is also involved in the formation of a gall, remains thereof being found usually adhering to the older galls.

Normal stems sometimes appear to have grown out from the surface of the older galls. Accessory stem structures occur, probably originating in a branching of the main stem in the gall. Broad, ray-like masses of parenchyma, surrounded by tracheids, are of somewhat common occurrence. Irregularly twisted masses of fibrovascular tissue resembling like structures in traumatic wood also occur. Cells apparently transitional between parenchyma and tracheids are not uncommon. The irregularly running bundles in the gall are composed largely of scalariform tracheids.

A bibliography is given.

Calcium hypochlorite as a seed sterilizer, J. K. WILSON (*Amer. Jour. Bot., 2 (1915), No. 8, pp. 420–427*).—The author gives a summarized compilation of the methods employed by the several investigators named in this connection, and describes his own experiments for sterilizing seeds with calcium hypochlorite.

The considerable number of tests made and the results obtained as shown are held to demonstrate the efficacy of the method used, employing the bleaching powder as an aid in securing sterile plantlets from seed. Ease of application and freedom of the seed from injury except after long exposure are further advantages claimed for the method. The effect of the solution is thought to be due to the hypocholorous acid, which acts as a toxic agent.

Some notes on Bordeaux and Burgundy mixtures, S. F. ASHBY (*Jour. Jamaica Agr. Soc., 19 (1915), No. 9, pp. 342–345*).—Discussing the composition and merits of some proprietary and other spraying preparations, the author concludes that the ready-made powders intended to replace homemade Bordeaux and Burgundy mixtures are prepared on the wrong principle, being merely mechanical mixtures of the ingredients and not the finished product of their mutual action, so that the great advantage of a finely suspended solid, which can be secured only by mixing weak solutions, is lost, and a coarse, rapidly settling mixture results. The homemade mixtures are deemed less expensive and more satisfactory as to results, but somewhat more troublesome to prepare. Formulas and directions for their use are given, and the relative costs are discussed, with the particular adaptations of each preparation.

Tests with Perocid, F. STRANAK (*Deut. Landw. Presse, 42 (1915), Nos. 62, pp. 537, 538; 63, pp. 544–546, figs. 7*).—This is an account of tests with a proprietary preparation containing certain radio-active substances. For this value is claimed as a fungicide, chiefly in connection with cereals, and also as an energizer of the growing plantlets.

Experiments on the control of cereal diseases by steeping the seed grain, E. RIEHM (*Illus. Landw. Ztg., 35 (1915), No. 24, pp. 161, 162*).—Good results as regards smut control are claimed to have been obtained by soaking the seed grain from 10 to 60 minutes in 0.1 to 0.2 per cent of mercury chlorophenol, or in 0.1 per cent of corrosive sublimate, or for 15 minutes in 0.1 per cent of formaldehyde (which was less injurious to germinability), but less satisfactory results followed the use of 0.1 per cent of chinosol for 10 to 20 minutes, or of 0.2 per cent of chinosol for 5 to 15 minutes.

Leaf stripe (*Helminthosporium gramineum*) appears not to have been lessened by steeping the grain in formaldehyde of 0.1 per cent strength for from 10 to 30 minutes, but copper sulphate of 0.5 per cent strength for the same period reduced the disease considerably, and 1 per cent reduced attack to about 0.5 per cent of the grain sown. Mercury chlorophenol and chinosol also appear to be practical remedies for leaf stripe.

Tests on the control of Fusarium in relation to the preservation of germinability are considered to show that chinosol is not to be recommended unreservedly in this connection. Uspulum, a trade preparation of mercury chlorophenol, is said to have about equal value with corrosive sublimate, while formaldehyde has somewhat less.

Smut control, O. Appel (*Mitt. Deut. Landw. Gesell., 30 (1915), No. 37, pp. 551, 552*).—This is a discussion of some methods for the control of grain smuts which are claimed to be sufficiently safe, suitable, and inexpensive to warrant their employment in the present situation in Germany. These include washing the seed grain by hand, treating with from 0.1 to 0.2 per cent of formaldehyde, and steeping in water at 45° C. (113° F.) for two hours or at 40° for from six to eight hours, or a combined treatment by steeping in water at from 25 to 30° for four hours (or one hour and covering the grain from six to eight hours) and then for from five to ten minutes in water at from 50 to 52°.

[Grain rusts], E. Riehm (*Deut. Landw. Presse, 42 (1915), No. 49, pp. 433, 434, pl. 1, fig. 1*).—This is a descriptive discussion of black rust (*Puccinia graminis*) on wheat, rye, barley, and oats; yellow rust (*P. glumarum*) on wheat, rye, and barley; brown rust (*P. triticina*) on wheat; brown rust (*P. dispersa*) on rye; crown rust (*P. coronifera*) on oats; and dwarf rust (*P. simplex*) on barley.

[Injurious influences affecting winter rye], K. Störmer (*Deut. Landw. Presse, 42 (1915), Nos. 65, pp. 559–561; 66, pp. 572, 573, fig. 1*).—This is a discussion of weather, soil, and plant and animal parasites as affecting rye production in 1914–15 in Pomerania, with more particular reference to Fusarium as related to foot rot and to remedies therefor. A proprietary preparation of corrosive sublimate is recommended as preferable to copper sulphate or formaldehyde in this region.

Climatic conditions as related to Cercospora beticola, Venus W. Pool and M. B. McKay (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 1, pp. 21–60, pls. 2, figs. 10*).—The results are given of a study carried on at Rocky Ford, Colo., from 1911 to 1913, and near Madison, Wis., during 1914, to determine the climatic conditions of both winter and summer as bearing on the vitality and development of *C. beticola*. Notwithstanding the differences in temperature and soil moisture conditions, similar results were obtained from the overwintering experiments at both places.

When exposed to outdoor conditions, the conidia of the fungus die in sugar beet top material in from one to four months, but when kept dry, they may remain alive as much as eight months. The sclerotia-like bodies which are embedded in the tissues of the host are more resistant than the conidia and live through the winter when only slightly protected, becoming a source of infection for the succeeding crop.

Tests of artificial cultures showed that exposure to constant temperatures of from 95 to 97° F. was fatal to the growth of the fungus, but that when exposed for three days to either of these temperatures and then changed to 87°, growth followed, as was also the case when cultures were held at either of these temperatures for eight hours and then at 68° for 16 hours. A temperature of 105° was found fatal in all combinations tested.

Temperature and relative humidity were found to influence production of conidia and infection in much the same way. A temperature of from 80 to 90°, with a night minimum preferably not below 60°, was most favorable to conidial production, which was checked by a temperature of 100° or higher and retarded by a range from below 50 to 80°. A maximum humidity ranging above 60 for not less than 15 to 18 hours each day induced a good growth of the fungus. Because of the higher humidity on the lower than on the upper surface of the leaf, the conidia are generally more abundant on the lower surface of the spots, and because of the action of rain and wind they disappear more rapidly from the upper surface.

Control of club root of crucifers, F. Burkhardt (*Möller's Deut. Gärt. Ztg., 30 (1915), No. 34, pp. 274, 275, fig. 1*).—Control measures recommended for *Plasmodiophora brassicæ*, causing club root of crucifers, include rotation, the application of 500 gm. of freshly slaked lime per square meter in the fall, followed in the spring by 50 gm. of a potassium salt with well rotted compost, careful selection of stock for planting, and removal of any unthrifty plants.

Flax disease investigations (*North Dakota Sta. Rpt. 1915, pt. 1, p. 16*).—The investigations in flax diseases, which have been in progress for some time, are briefly described. Special centgener plantings have been made to increase resistance of flax to rust and wilt.

The results for the year covered by this report are said to indicate that resistance can be developed to an extent that will practically control these diseases. Trials were made of seeds sent in by farmers to be tested for resistance, the results of which seem to indicate that resistance power, when once acquired, will endure for a considerable period, even though the crop is grown on ground free from the diseases. Crops grown from seed which had been wet, moldy, or frozen showed diminished powers of resistance.

A Rhizoctonia disease of licorice, W. Himmelbaur (*Ztschr. Landw. Versuchsw. Österr., 17 (1914), No. 8–9, pp. 671–683, figs. 9*).—Giving the results of microscopic and microchemical studies on a Rhizoctonia disease said to decrease materially the returns from Glycyrrhiza, the author describes the development of the fungus and of the alterations caused thereby. It is stated that the diseased portion soon takes on somewhat the character of a foreign body, having been separated more or less completely by a cork layer from the healthy portions.

Investigations of potato diseases (*North Dakota Sta. Rpt. 1915, pt. 1, pp. 17, 18*).—It is reported that the Fusarium wilt, Fusarium rot, brown stem rot, Rhizoctonia, and leaf roll of potatoes are of economic importance in the potato districts of North Dakota. These diseases appear to be more active in the lighter soil areas, while early blight is reported as occurring extensively in the region of heavier soils.

The frequent occurrence of Rhizoctonia on potato vines has led to a study of that organism. In samples of soil collected from 24 plats that had been devoted to crop rotation for 24 years, 18 lots showed the presence of *Corticium vagum*. Many of these plats had not been cropped to potatoes for many years. As a result of the investigation it is considered probable that Rhizoctonia occurs on the roots and débris of a large variety of plants, and that the present method of treating seed potatoes to avoid this disease is correspondingly futile.

Potato diseases, O. Schlumberger (*Deut. Landw. Presse, 42 (1915), No. 41, pp. 369, 370, pl. 1*).—This includes a description of Phytophthora tuber rot, bacterial wet rot, Fusarium or dry tuber rot, verticilliose or wilting disease, bacterial ring rot, hollow tubers, various spotting diseases, Oospora scab, Spongospora powdery scab, canker (*Chrysophlyctis endobiotica*), and Rhizoctonia disease. Some preventive and remedial measures are also discussed.

Filosity in young potato plants, P. PASSY (*Jour. Soc. Nat. Hort. France, 4. ser., 15 (1914), July–Dec., pp. 500, 501*).—Of two potato tubers which had been subjected to the same conditions, one was shown to have produced normal sprouts, while the other exhibited a clearly marked case of filosity. The facts are supposed to refute the views of Parisot (E. S. R., 23, p. 148) that this abnormality in growth is due to an accumulation of carbon dioxid during storage.

Downy mildew (Sclerospora macrospora) on rice, L. GABOTTO (*Gior. Risicolt., 5 (1915), No. 18, pp. 292–294, fig. 1*).—A disease of rice is described as due to *S. macrospora*. The head, if it emerges, is distorted and empty of grain, owing to atrophy or transformation of the essential floral organs.

A stem disease of sugar cane in Barbados, W. NOWELL (*Agr. News [Barbados], 15 (1916), No. 357, p. 14*).—The author has examined a sugar cane disease appearing in Barbados, said to be similar to or identical with that occurring in India and described by Butler and Hafiz (E. S. R., 30, p. 650) as due to *Cephalosporium sacchari*.

The disease appeared to be partly or entirely confined to canes whose water supply had been interfered with as a result of wrenching by high winds or of the development of *Marasmius sacchari* in the cane base. Some of the symptoms resembled those of red rot. *Melanconium sacchari* usually appeared as a secondary infection.

C. sacchari is thought to be widely distributed in the West Indies, and it may be a factor in what appears to be a somewhat serious disease.

Sweet potato diseases, L. L. HARTER (*U. S. Dept. Agr., Farmers' Bul. 714 (1916), pp. 26, figs. 21*).—This is a compilation of popular information regarding sweet potato diseases, which, it is said, may be divided into three general classes, those attacking the roots and stems, stem rot, black rot, foot rot, scurf, and root rot; those of the leaf, leaf blight, white rust, and leaf spot; and those developed in storage, soft rot, black rot, dry rot, Java black rot, and charcoal rot. The different diseases are described and suggestions given for their control.

Apple rust, N. J. GIDDINGS and A. BERG (*West Virginia Sta. Bul. 154 (1915), pp. 4–73, figs. 41*).—This is a detailed account of investigations of apple rust and its control, a preliminary account of which has been noted (E. S. R., 33, p. 348). In the present bulletin, a technical account is given of the organism, *Gymnosporangium juniperi-virginianæ*, its distribution, conditions for infecting the host plants, and its physiological effect on both apple and cedar, after which spraying and other methods of control are described.

The authors report that apple leaves are susceptible only when young, and that rust infection is not likely to take place after the first week in June in the latitude of the station. Severe rust infections cause a deforming of the fruit and a reduction in size, with a considerable loss of vigor in the tree.

It is said that the disease may be controlled by the use of Bordeaux mixture, lime sulphur, or atomic sulphur, lime sulphur being the most efficient, but the use of fungicides is deemed impracticable for commercial orchardists. The destruction of cedar trees is considered a more effective method of control, and this has been carried out on a small scale, 1,113 acres being cleared of cedar trees at a cost less than 48 cents per acre.

A disease of apricot in Valais, H. FAES (*Terre Vaud., 6 (1914), No. 25, pp. 282, 283*).—Referring to a report made to the Department of Valais, Switzerland, on a disease of apricot observed to be particularly severe at Saxon in 1914, the author states that the trouble, which is described as due to *Monilia fructigena (M. laxa)*, causes much loss following damp weather and rains.

Preventive treatments, including copper sprays and polysulphids, have not proved to be effective. Suggestions are given regarding the employment of phosphorus and potassium fertilizers and measures for securing earlier ripening of the wood.

A disease of apricot in the Rhone Valley, J. CHIFFLOT and MASSONNAT (*Rev. Hort. [Paris], 87 (1915), No. 27, pp. 540, 541*).—In portions of the Rhone Valley apricot trees are said to be affected with a disease characterized by the drying of the flowers, leaves, and young branches, followed by gummosis, separation of the bark from the wood, and discoloration of the latter. The trouble appears to be caused by the same fungus as that reported above by Faes as occurring in Switzerland.

Spring conditions will not permit the use of strong sprays, but removal of all affected portions is recommended. In winter, the use of copper sprays at 1.2 per cent strength is advised, with the addition of soap and gelatin to secure better spreading and adhesion.

Summer outbreaks of downy mildew, H. FAES (*Terre Vaud., 6 (1914), No. 32, pp. 338–341*).—Recent tests have confirmed the view that mildew attack on grape leaves occurs by way of the lower surface only, and that spraying from below is sufficient if the fungicide is applied thoroughly and in proper strength, preferably with an admixture of materials suited to increase its spreading and sticking qualities. The attack is said to occur mainly when the leaves are young, but it may occur later.

Spotting of citrus fruits, H. S. FAWCETT (*Mo. Bul. Com. Hort. Cal., 4 (1915), No. 9, pp. 434, 435*).—It is stated that for a number of years past, especially during moist, cool weather, lemons and sometimes oranges have been observed to develop, after coming to the packing house, green spots which may later become brownish or reddish and somewhat sunken, and which do not increase in size after their formation.

It has been shown that typical green spots can be developed by so pressing and rolling lemon fruits against boards as to cause injuries, also that oil from one lemon pressed out on the injured surface of another produced the typical sinking of the tissue between the oil cells. Green spots were produced by presssure on the surface of the rind sufficient to liberate the oil but not sufficient to cause a visible break in the rind. It has also been noticed that picking green fruit while wet favored the formation of the spots. The oil on fruit kept in moist air produced a greater effect than on fruit kept dry, which is thought to be due to its slower volatilization under these circumstances.

The picking of the fruit only under dry conditions is recommended.

Work connected with insect and fungus pests and their control (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Dominica, 1914–15, pp. 11–17, fig. 1*).—This reproduces a preliminary report by W. Nowell on his investigation of the black root disease of lime trees in Dominica caused by *Rosellinia bunodes*, said to be the only disease of lime trees of really serious importance in the island at the time. The disease is known only on estates with fairly recent forest clearings. It is thought to be distinct from a closely similar disease on cacao. Soil and situation favorable to the rapid development of the lime trees seem also to favor the disease. The greater seriousness of the disease during the years reported upon is ascribed largely to a period of extremely wet weather, but still more to the cumulative character of the disease and the increased number of contacts among the growing and interlacing roots. On reaching the light, the fungus produces spores, which can cause infection some distance from the point of origin.

It appears that thorough ventilation of the collar and of the main roots near their points of attachment, in addition to rendering early detection easy, may

considerably delay, if not stop, the progress of the disease. The use of carbon bisulphid is to be tested in connection with this disease. The first precaution, the destruction of the trees by fire, is said to be rendered easy by the inflammable nature of the wood.

As no case of the disease on sour orange has been noted, it is thought that this apparent immunity, if confirmed, may prove to be of great importance. A system of isolation and drainage is shown to have been effective in the one instance in which it was given a thorough trial, as the trees looked well and dying in patches was entirely prevented.

The pink disease of lime branches due to *Corticium lilacino-fuscum* is said to exist on some estates. While it is not yet sufficiently abundant to possess much economic importance, destruction of diseased branches is advised.

Diseases of tulip and hyacinth, J. C. T. Uphof (*Möller's Deut. Gärt. Ztg., 30 (1915), Nos. 37, pp. 295, 296; 38, pp. 306, 307*).—The author suggests the trial in connection with the ring disease of hyacinth and tulip of the plan which J. Ritzema Bos is said to have found successful with onions. This consists essentially in the treatment of the soil about the end of March, before planting in the middle of April, with lime and ammonium sulphate, ammonia being set free and giving practical disinfection of the soil.

A disease of tulip due to *Sclerotium tuliparum*, which also frequently attacks *Iris hispanica*, occasionally hyacinth, gladiolus, and *Fritillaria imperialis*, and rarely narcissus, is thought to be controllable by the three-year rotation, tulips, potatoes, and hyacinths. The disease of tulip caused by *Botrytis parasitica* is most satisfactorily dealt with by removal and destruction of affected plants.

Variation and blight resistance among walnuts, L. D. Batchelor (*Mo. Bul. Com. Hort. Cal., 4 (1915), No. 9, pp. 428–430*).—Giving the results of observations on productivity, blight resistance, and season, the author states that this disease is the greatest limiting factor for walnut production in the principal walnut growing countries. It is considered that a tree which has only 10 per cent of blighted nuts in an orchard which averages from 70 to 80 per cent may be really more resistant than one apparently free from disease among others which are only from 15 to 20 per cent blighted. Examples given show a wide range of susceptibility to attack in different varieties named.

Contributions on the life processes of oak mildew, J. Roth (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 6–7, pp. 260–270*).—The author presents, as supplementary to the work of Neger (E. S. R., 33, p. 745), his own observations and experiments on oak mildew.

The fact that this disease flourishes best in situations exposed to sunshine is thought to be attributable to the influence of the sun on the host rather than on the parasite, which prefers the tender, later maturing growth made by the shoots in open situations. The relations of shading to parasitic growth in case of other plants are also discussed.

The publications of the Pennsylvania Chestnut Tree Blight Commission (*Harrisburg: State, 1915, pp. 641, pls. 180, figs. 7*).—This is a collection of the papers issued by the Pennsylvania Chestnut Tree Blight Commission, most of which have been previously noted.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The prairie dog situation in Colorado, W. L. Burnett (*Off. State Ent. Colo. Circ. 17 (1915), pp. 15, figs. 2*).—This circular, which is intended to replace Circular 8, previously noted (E. S. R., 30, p. 249), deals with the occurrence of the plains prairie dog (*Cynomys ludovicianus*), the white-tailed prairie dog (*C. leucurus*), and the Gunnison prairie dog (*C. gunnisoni*) in various counties

of Colorado. A brief description is then given of their habits and economic status and methods of combating.

The prairie dog situation, R. K. NABOURS (*Kansas Sta. Circ. 54 (1915), pp. 4*).—This abridgment of Circular 4, previously noted (E. S. R., 22, p. 457), treats of the methods of combating prairie dogs.

Meadow mice, W. L. BURNETT (*Off. State Ent. Colo. Circ. 18 (1916), pp. 11, figs. 2*).—A brief description is given of five species and subspecies of Microtus found in Colorado. The food habits of the different species are so similar that they are treated as a whole, and brief consideration is given to their natural enemies, damage in the United States, possibility of an outbreak in Colorado, how to save girdled trees, breeding, and methods of combating.

Effect of 186–515 generations of Danysz bacillus in a ten per cent decoction of egg albumin on the gray rat (Mus decumanus), S. S. MEREZHKOVSKIĬ (*Trudy Selsk. Khoz. Bakt. Lab., 4 (1913), pp. 138–149*).—A mortality of 84 per cent was caused among gray rats fed upon the Danysz bacillus (generations 186–515), obtained by their uninterrupted culture in a 10 per cent decoction of egg albumin.

Duration of the virulence of agar cultures of the Danysz bacillus, S. S. MEREZHKOVSKIĬ (*Trudy Selsk. Khoz. Bakt. Lab., 4 (1913), pp. 181–185*).—The investigations here reported show that the virulence of agar cultures of the Danysz bacillus may be preserved for at least 1.5 years when kept under favorable conditions.

Experiments made in 1912 in the Government of Bessarabia with the Siberian marmot, S. S. MEREZHKOVSKIĬ (*Trudy Selsk. Khoz. Bakt. Lab., 4 (1913), pp. 207–236, figs. 4*).—A report of experimental work with the Danysz bacillus in which unsatisfactory results were obtained due to the high natural mortality which occurred among the rodents.

On Giardia microti sp. nov., from the meadow mouse, C. A. KOFOID and ELIZABETH B. CHRISTIANSEN (*Univ. Cal. Pubs., Zool., 16 (1915), No. 2, pp. 23–29, fig. 1*).—This species causes inflation of the intestines of the meadow mouse, the walls of the intestines becoming thin and flaccid and assuming a yellowish-orange color in the infected region.

Propagation of wild birds, H. K. JOB (*Garden City, N. Y.: Doubleday, Page & Co., 1915, pp. XII+276, pls. 65*).—A manual of applied ornithology treating of practical methods of propagation of quails, grouse, wild turkey, pheasants, partridges, pigeons and doves, and waterfowl in America, and of attracting and increasing wild birds in general, including song birds.

A new interpretation of the relationships of temperature and humidity to insect development, W. D. PIERCE (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 25, pp. 1183–1191, figs. 2*).—The studies here presented are based principally upon records of thousands of individual boll weevils (*Anthonomus grandis* and *A. grandis thurberiæ*) made by agents of the Bureau of Entomology of this Department in the Southwest extending over a long period of years.

Following a brief introduction and discussion of experimental methods, the subject is dealt with under the headings of zones of climatic relations, effective temperature, zone of inactivity, nomenclature of climatic effects on life, and practical applications. The author describes his method of computing effective temperatures and with a chart shows his method of determining the zone of effective temperatures at a humidity of 56 per cent. A chart and data are also given which show the relations of temperature and humidity to cotton boll weevil activity.

Attention is called to the fact that only in recent years has it been generally accepted that each species of insect, etc., may have a different zero of effective

temperature. It is pointed out that there is an absolute minimum fatal temperature below which, even for the shortest time, life is impossible and that there is also a corresponding absolute maximum fatal temperature; and that absolute dryness is more or less prohibitive of life, as is absolute humidity, i. e., saturation.

In working out the relation of temperature and humidity the diagrammatic figure sought has four definite absolute boundaries—the maximum and minimum temperatures and humidities. "Within the limits which we have thus defined there exist conditions under which all the activities of the species reach their maximum efficiency. It has been conceived by most writers that this maximum efficiency was reached at a definite point known as the optimum. It seems more likely that it will prove to be a zone of humidities and temperatures of more or less restricted area. A careful study of the records of any species, charting for the time required for each activity and the temperature and then similarly for humidity, will disclose temperature and humidity points of maximum efficiency. With the boll weevil these points lie approximately near 83° F. and 65 per cent of relative humidity."

Hydrocyanic acid gas.—Its practical use as a routine fumigant, R. H. Creel, F. M. Faget, and W. D. Wrightson (*Pub. Health Rpts.* [*U. S.*], *30* (*1915*), *No. 49, pp. 3537–3550, fig. 1*).—The authors here present the results of 19 practical experiments with hydrocyanic acid gas.

The results of several experiments with decreasing amounts of chemicals indicate that the use of 5 oz. of potassium cyanid to 1,000 cu. ft. of space is as effective as twice that amount. "It was clearly demonstrated that the quickest and best results were obtained by the use of powdered potassium cyanid, the chemical action being much facilitated and more rapidly completed. . . . Attempts to destroy bacteria with this fumigant were unsuccessful.

"It was noticed that where the rodents were allowed to run at liberty within the room during fumigation, and in the cases of the more active ones in cages, the effects of the gas were earlier apparent and more marked, and the rodents succumbed more quickly. Any physical efforts of the rodents seemed to hasten the effects of the gas, presumably by increased respiratory action. The cyanid gas apparently diffuses very rapidly, rising first to the top of a closed space, thence following along the walls to the floor, and finally reaching the center of the space."

Cyanid gas was found to be much more penetrating than sulphur dioxid, and thus it is to be preferred for fumigating ships loaded with cargoes. From the experiments it would seem that one-half hour is sufficient exposure when cyanid gas is used as a fumigant, and that the increasing of this period to one hour ought to suffice, even when unusually large spaces are fumigated. One of the experiments indicates that holds of ships will not retain cyanid fumes so as to be dangerous to life 30 minutes after the hatchways are removed.

Fifteenth report of the state entomologist of Connecticut for the year 1915, W. E. Britton (*Connecticut State Sta. Rpt. 1915, pt. 2, pp. VII+81–192, pls. 17, figs. 6*).—The first part of this report is taken up by a statement relating to the finances and routine work, including the inspection of nurseries, of imported nursery stock, of apiaries, etc.

Reports of Gipsy Moth Suppression Work in 1915 (pp. 99–111) and of Brown-Tail Moth Work, Season of 1914–15 (pp. 111–114), by W. E. Britton and I. W. Davis, next presented, are followed by a report of Experiments in Controlling the Cabbage Maggot in 1915, by W. E. Britton and Q. S. Lowry (pp. 114–118) in continuation of investigations of 1914, previously noted (E. S. R., 33, p. 58). The season was particularly favorable for control experiments, as the maggots were very abundant and caused more damage than usual. The best results

appear to have been obtained from the use of tar paper disks, the infestation of the plants thus protected being 4.4 per cent as compared with an infestation of 6 per cent on plants treated with crude carbolic acid emulsion.

A general account of A Destructive European Pine Sawfly in Connecticut (*Diprion* [*Lophyrus*] *simile*) is next presented by the author (pp. 118–125). This sawfly, an account of which has been previously noted (E. S. R., 34, p. 363), was first discovered in a nursery at New Haven in August, 1914. Since the publication of the article mentioned, it has also been found at Derby, Hartford, New Canaan, and Greenwich.

An account is next given of the Larch Sawfly (*Lygæonematus* [*Nematus*] *erichsonii*) (pp. 125–134), which, although it has undoubtedly occurred in Connecticut for many years, was not observed until 1915 when specimens were received from East Canaan. Accounts by Hewitt relating to this pest have been previously noted (E. S. R., 28, p. 658).

Experiments in Controlling the White Pine Weevil in 1915 (pp. 134–136) and Fumigating a Grapery with Hydrocyanic Acid Gas to Kill Mealy Bugs (pp. 136, 137) are reported upon by B. H. Walden. Brief accounts of The Juniper Webworm (*Dichomeris marginellus*) (pp. 137–139) and Three Species of Scale Insects New to Connecticut, namely *Leucaspis japonica, Lepidosaphes newsteadi,* and *Diaspis echinocacti* (pp. 139, 140), and a discussion of Mosquito Conditions in Connecticut in 1915 (pp. 141–144) follow. The Report on a Mosquito Survey at the Mouth of the Connecticut River, by P. L. Buttrick (pp. 144–172) has been previously noted (E. S. R., 34, p. 856). A discussion of the Changes in the Vegetation of Salt Marshes Resulting from Ditching, by W. E. Britton, B. H. Walden, and P. L. Buttrick (pp. 172–179), and an account of White Grub Injury in 1915 (pp. 179–181) are next given.

The report concludes with a brief discussion of the entomological features of 1915 (pp. 181–183) and of miscellaneous insect notes (pp. 183–191), relating to the banded fleabeetle (*Systena tæniata*) which was ablndant and caused injury to beans, tomato, eggplant, and sunflower at North Haven by feeding upon the leaves; unusual galls upon wild rose; the lime tree spanworm (*Erannis tiliaria*) found feeding upon the birch at New Haven; a parasite of the San José scale, *Prospaltella perniciosi*, a large number of which were reared during the year; the buffalo tree hopper which injured apple twigs at Wethersfield; a leaf roller on privet (*Archips rosana*); the false apple red bug (*Lygidea mendax*), which was the source of considerable injury in the southwestern corner of the State; a sawfly on imported manetti rose stock (*Emphytus cinctus*); the linden borer (*Saperda vestita*), said to have caused considerable injury to linden trees; two psyllids new to Connecticut, namely, *Psylla buxi* and *Spanioneura fonscolombii;* the strawberry rootworm (*Typophorus canellus*) at New Haven; a woolly aphis (*Pemphigus acerifolii*) on silver maple at Derby; white ants (*Leucotermes* [*Termes*] *flavipes*) in a house at Ridgefield; the chrysanthemum leaf miner (*Phytomyza chrysanthemi*); a new leaf weevil in Connecticut (*Polydrusus impressifrons*); a tortricid (*Tortrix albicomana*) on oak; the iris borer (*Macronoctua onusta*); mites (*Rhizoglyphus hyacinthi*) injuring Bermuda lilies; a new enemy of peach trees (*Diplotaxis atlantis*); and aphids (*Aphis rumicis, Macrosiphum solanifolii,* and *Myzus persicæ*) on seed beets.

[Economic entomology] (*Ztschr. Angew. Ent., 1 (1914), No. 2, pp. 244–320, figs. 24*).—The papers here presented include the following: The Occurrence of the Pink Bollworm (*Gelechia gossypiella*) in Egypt, by A. Andres (pp. 244–247); The Grapevine Moths or Traubenwicklers (*Polychrosis botrana* and *Cochylis ambiguella*) and Their Natural Enemies in South Tyrol, by C. Catoni (pp. 248–259); Injurious and Beneficial Insects in Dry and Manufactured Tobacco,

by K. Escherich (pp. 260–265); The Status of Economic Entomology in India, by H. Morstatt (pp. 266–271); The Relation of *Stomoxys calcitrans* to Infantile Paralysis, by K. H. C. Jordan (pp. 272–276); The Mycological Investigations of Fungus Diseases of Insects and Economic Entomology, by G. Lakon (pp. 277–282); and The History of Nematus Injury in the Royal Saxony State Forest Reserve of Naunhof near Leipsic, by P. Jaehn (pp. 283–320).

Report of the economic biologist, G. E. Bodkin (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1913–14, App. 3, pp. 11*).—A brief statement of the work of the year, including revised lists of insects injurious to sugar cane with their parasites and of the insect pests of the coconut palm in British Guiana.

Report of the imperial entomologist, T. B. Fletcher (*Rpt. Agr. Research Inst. and Col. Pusa, 1913–14, pp. 62–75*).—A statement of the work of the year.

Sinuate pear borer and leopard moth, P. J. Parrott and H. Glasgow (*New York State Sta. Circ. 44 (1915), pp. 3, pls. 2*).—This circular gives brief descriptions of the sinuate pear tree borer and leopard moth, which, as shown by a recent survey by the station, are being distributed into the fruit-growing sections of the State by importations of nursery stock.

Destruction of prickly pear through the agency of parasitic insects, J. White-Haney (*Ann. Rpt. Dept. Pub. Lands Queensland, 1914, pp. 81–83, pls. 3*).—This account relates to the propagation of wild cochineal insects (*Coccus indicus* from Ceylon and *C. confusus capensis* from South Africa). See also work previously noted (E. S. R., 34, p. 549).

The insect enemies of vegetables, J. Kindshoven (*Flugschr. Deut. Landw. Gesell., No. 13, 4. ed. (1915), pp. 16–27*).—In this edition (E. S. R., 27, p. 438) a brief summarized account is given of the more important insect enemies of vegetables in Germany and means for their control.

Insects attacking cabbage and allied crops in Connecticut, W. E. Britton and Q. S. Lowry (*Connecticut State Sta. Bul. 190 (1916), pp. 3–23, figs. 17*).—Brief popular accounts are given of the more important enemies of crucifers occurring in Connecticut.

Insects affecting the sugar cane in Trinidad, F. W. Urich (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 5, pp. 156–161*).—The author has compiled the present list of sugar cane insects with the object of providing a handy reference to these pests, their natural enemies, and methods of control.

The insect enemies of strawberries, A. Tullgren (*Trädgården [Stockholm], 14 (1915), No. 6, pp. 167–169, figs. 2; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 11, p. 695*).—A brief account of the enemies of strawberries in Sweden.

Cranberry insect investigations in 1914, H. B. Scammell (*Proc. Amer. Cranberry Growers' Assoc., 45 (1914), pp. 12–17*).—The work of the year is briefly reviewed.

Some inhabitants of the round gall of golden-rod, Chi Ping (*Jour. Ent. and Zool., 7 (1915), No. 3, pp. 161–179, figs. 20*).—The inhabitants of round galls which occur commonly on only one species of golden-rod (*Solidago canadensis*), here dealt with, include *Eurosta solidaginis*, the gall-making fly; the larvæ of the mordellid beetle *Mordellistina unicolor*; and several other occupants, three of which are parasites and the rest of uncertain position. A tabular statement of the inhabitants of 3,300 galls is included and a bibliography of 17 titles is appended.

Destructive grasshoppers in Costa Rica, A. Alfaro (*Reprint from Rev. Ed. San José, Costa Rica, 1915, Oct., p. 7, fig. 1; abs. in Ent. News, 26 (1915), No. 10, p. 447*).—An account is given of the invasion of Costa Rica by locusts (*Schistocerca paranensis* and *S. zapoteca*) during 1915.

The control of locusts in eastern Canada, A. GIBSON (*Canada Dept. Agr., Ent. Branch Circ. 5 (1915), pp. 8, figs. 6*).—A brief discussion of the destructive species and control measures therefor.

On the destruction of locusts by cultures of the d'Herelle bacillus, S. S. MEREZHKOVSKIĬ (*Trudy Selsk. Khoz. Bakt. Lab., 4 (1913), pp. 368, 369*).—In experiments made with the d'Herelle bacillus obtained from the Pasteur Institute in Paris, the Pasteur Institute in Algiers, and Argentina it was found that from three to six types were represented. The author recommends that the pathogenic properties of the organism at hand be determined before cultures are used in practical work.

Injury to cereals by Ælia rostrata, R. RODRIGUEZ Y MARTIN (*Bol. Agr. Téc. y Econ., 6 (1914), No. 70, pp. 934–943, figs. 8*).—This hemipteran, commonly known as "San Pedrito," is the source of considerable injury to wheat in Spain.

Chermes injurious to conifers, N. A. CHOLODKOVSKY (*Khermesy, Vredíashchie Khoĭnym Derev'íam. Petrograd: Dept. Agr. Central Bd. Land Admin. and Agr., 1915, 2. rev. and enl. ed., pp. 89, pls. 7, figs. 6; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 10, pp. 592–599*).—An extended account.

Plant lice or aphids, H. A. GOSSARD (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 108–114, figs. 6*).—This is a popular account of the life history and habits, reproduction, natural enemies, nature of damage, and means of combating plant lice.

Aphididæ of California, XI, E. O. ESSIG (*Jour. Ent. and Zool., 7 (1915), No. 3, pp. 180–200, figs. 9*).—In this paper, the eleventh of a series of articles (E. S. R., 28, p. 452), the author considers a new Lachnus (*L. glehnus* n. sp.) which injures the Japanese dwarf silver spruce (*Picea glehni*) at Sacramento, Cal., the manzanita leaf-gall aphis (*Phyllaphis coweni*), and the cloudy-winged oak aphis (*Callipterus bellus*).

The army worm (Cirphus [Leucania] unipuncta), A. GIBSON (*Canada Dept. Agr., Ent. Branch Bul. 9 (1915), pp. 34, figs. 19*).—A summarized account of the fall army worm, its life history and habits, natural enemies, and methods of control.

A detailed account is given of the 1914 outbreak in eastern Canada, as the result of which the loss in Ontario alone amounted to more than $250,000. The parasites reared during the course of the outbreak include four tachinids (*Winthemia quadripustulata, Phryxe* [*Exorista*] *vulgaris, Phorocera* [*Euphorocera*] *claripennis*, and *Wagneria* [*Phorichæta*] *sequax*); four braconids (*Apanteles militaris, Apanteles* sp., *A. limenitidis*, and *Meteoris communis*); and six ichneumonids (*Paniscus geminatus, Pimplidea pedalis, Ichneumon canadensis, I. laetus, I. jucundus*, and *I. leucaniæ*).

Some notes on the Catalina cherry moth, E. J. BRANIGAN (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 1, pp. 35, 36, figs. 2*).—The fruit of the Catalina cherry (*Prunus integrifolia*) at Sierra Madre in Los Angeles County, Cal., was found to be badly infested with the larvæ of *Mellissopus latiferreana*, a moth which closely resembles the codling moth. "The infestation was very heavy. The larva works both in the meat of the fruit and within the seed itself, which is comparatively very large, occupying three-fourths of the inside of the cherry. The cherry averages about the size of the cultivated species of cherry. The larva seems to have a preference for the seed, the shell of which is not very hard."

Statistics on the production of silk in France and elsewhere (*Statistique de la Production de la Soie en France et a l'Etranger. Lyon: Syndicat de l'Union des Marchands de Soie de Lyon, 1915, pp. 84*).—Statistical data including the year 1913 relating to silk production are here presented under the

headings of occidental Europe, the Levant and central Asia, and the extreme Orient.

The biology of the North American crane flies (Tipulidæ, Diptera).—IV, The tribe Hexatomini, C. P. ALEXANDER (*Jour. Ent. and Zool., 7 (1915), No. 3, pp. 141–160, figs. 17*).—A continuation of the work previously noted (E. S. R., 33, p. 561).

The bionomics of the Maltese phlebotomi, P. J. MARETT (*Brit. Med. Jour., No. 2848 (1915), pp. 172, 173*).—In this report of studies of the life history and habits of wild and tame Papatasii flies, which are of importance because of their transmission of disease, data are included on the length of the several life stages, including the pregnancy stage, egg stage, first larval and total larval stages, pupal stage, and length of life. A fungus, which is pathogenic to the fly, is provisionally termed *Empusa papatasii.*

Directions for combating the olive fly (Dacus oleæ), A. BERLESE (*Istruzioni per Combattere la Mosca delle Olive (Dacus oleæ). Florence: Min. Agr. Indus. e Com., 1915, pp. 11, figs. 8*).—A summary of control measures.

The book of the fly, G. H. HARDY (*London: William Heinemann, 1915, pp. [8]+124, figs. 224*).—This account of the house fly includes chapters on identification, structure, life history, economic importance, methods of control, etc. Miscellaneous data relating to flies, including the Windgate fly chart with index to terms and symbols, a list of families with descriptive notes and references, an analytical table of families, etc., are appended.

The cane grubs of Australia, A. A. GIRAULT and A. P. DODD (*Bur. Sugar Expt. Stas. Queensland, Div. Ent. Bul. 2 (1915), pp. 60; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 8, pp. 490, 491*).—The authors here present a detailed report of studies of the various phases in the life history and habits at Gordonvale, Queensland, of scarabæid larvæ attacking sugar cane. A preliminary report of the work by Girault has been previously noted (E. S. R., 33, p. 750).

A mission to Java in quest of natural enemies for a coleopterous pest of bananas (Cosmopolites sordida), F. P. JEPSON (*Dept. Agr. Fiji Bul. 7 (1914), pp. 18, pls. 3*).—Following a brief account of the life history of the banana borer (*C. sordida*), its natural enemies are considered.

The author found several insects to prey to a greater or less extent on the banana borer in Java, of which a histerid beetle (*Plæsius javanus*) was the most important. In captivity the adult of this beetle consumed eight full-grown larvæ of the banana borer per head per diem, while its larva took no less than 33.8 full-grown larvæ per head per diem, or an equivalent in bulk of about 17 times its own size.

Five thousand of these beetles were transported in moist earth without food from Java to Fiji, and 3,792 were successfully landed at Suva, the remainder perishing, chiefly, it is believed, owing to the cold weather experienced on the coast of Queensland. Lots of 500 were distributed among seven different plantations in badly infested banana districts and 292 retained for observation. The beetles were alive and reproducing after four months, which points to their being probably established. Beetles sent from Java to Fiji by post, packed in damp moss, also arrived alive, so that there should be no difficulty in obtaining a further supply from Java if necessary.

The Colorado potato beetle (Leptinotarsa decemlineata), H. SCHABLOWSKI (*Ztschr. Pflanzenkrank., 25 (1915), No. 4, pp. 193–203, pls. 3, fig. 1; abs. in Möller's Deut. Gärt. Ztg., 30 (1915), No. 42, pp. 335, 336, figs. 2*).—An account is given of the appearance of this pest in Germany in 1914 and the manner in which it was eradicated.

Rice borers in Java, K. W. Dammerman (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten No. 16 (1915), pp. 71, pls. 7, figs. 2*).—Five species of rice borers are known at the present time in Java, namely, *Schoenobius bipunctifer, Scirpophaga sericea,* two species of Chilo, and *Sesamia inferens. S. bipunctifer,* which occurs throughout Java, and *S. sericea,* found principally along the north coast and the more common there of the two, are the two most important. Of the several parasites attacking rice borers, *Trichogrammatoidea nana* alone may destroy as high as 60 per cent of the eggs. The destruction of the borers which remain in the stubble after harvest by deep plowing is the most effective control measure.

A note on the western twig borer, H. S. Smith (*Mo. Bul. Com. Hort. Cal., 4 (1915), No. 12, pp. 572, 573, fig. 1*).—*Polycaon confertus* has become a pest of considerable importance in California.

The wheat straw worm (Isosoma grande), R. W. Doane (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 2, pp. 69–72, figs. 2*).—This pest has been found to be the source of considerable injury in northern California, actual counts of hundreds of wheat stems showing 84 per cent to be infested with one or more larvæ or pupæ of this insect.

Hen fleas (Xestopsylla gallinacea), J. F. Illingworth (*Hawaii. Forester and Agr., 12 (1915), No. 5, pp. 130–132*).—An account of the hosts, distribution and life history, and control measures for the hen flea, which appears to be a recent arrival in Hawaii, not having been collected by entomologists prior to 1913.

Notes on the habits and control of the chicken flea (Echidnophaga gallinacea), J. F. Illingworth (*Jour. Econ. Ent., 8 (1915), No. 5, pp. 492–495*).—A report of studies, a brief account of which has been noted above.

Observations on the preoviposition, oviposition, and incubation periods of Dermacentor nitens in Panama, L. H. Dunn (*Ent. News, 26 (1915), No. 5, pp. 214–219*).—A report of biological studies of the tropical horse tick.

Sarcophaga fuscicauda, an intestinal parasite of man, A. Eysell (*Arch. Schiffs u. Tropen Hyg., 19 (1915), No. 1, pp. 2–7, figs. 4*).—Descriptions are given of the larva, pupa, and adult of *S. fuscicauda* taken at Tsingtau.

FOODS—HUMAN NUTRITION.

The milling and baking quality and chemical composition of wheat and flour as influenced by different methods of handling and storing, heat and moisture, [and] germination, C. O. Swanson, L. A. Fitz, and Leila Dunton (*Kansas Sta. Tech. Bul. 1 (1916), pp. 83, pls. 22*).—The object of this investigation was to determine the effect of different methods of harvesting, stacking, and storing wheat; the aging effect of tempering with moisture and heat; and the effect of germination of new wheat on the milling quality of the wheat, the baking quality of the flour, and the chemical composition of the wheat and flour.

"All the tests were made on the same original lot of wheat. A 10-acre field of fairly uniform character was obtained. One acre was cut at the beginning of the hard-dough stage, one when the wheat was dead ripe, and the rest when the wheat was in prime condition. As soon as the wheat was dry, a few bushels were thrashed from the early and from the late cuttings, and 35 bu. from that cut in prime condition. Samples of the wheat from the three cuttings were taken to the laboratory for immediate milling, baking, and chemical tests. The wheat cut in prime condition was used for the study of the effect of germination, the process of sweating in the bin, and for treatments with heat and water. The larger part of the 10-acre field was stacked. One acre was allowed to stand in the shock."

In each series of experiments chemical analyses and milling tests were made of the wheat subjected to different treatments, as well as chemical analyses and baking tests of the flours milled from the wheat. Temperature and moisture observations were made in the storage experiments.

In the experiments to determine the aging effect of tempering with moisture and heat, the authors studied the effects of adding different amounts of water to the wheat and heating it to different temperatures for varying periods of time. These experiments showed that "heat, especially when used on new wheat, improves the milling quality of the wheat and the baking qualities of the flour. The interval that should elapse between the time the wheat is moistened and heated and the time that it is milled depends on the hardness of the wheat and the amount of moisture added. If the wheat has nearly the normal moisture content and is of good quality this 'curing' process does not seem to be so important. But where a large amount of moisture needs to be added it seems that this longer tempering is very beneficial. This was shown in the previous experiments. The miller should have at his command such facilities that he can treat the wheat with successive amounts of moisture, heat the wheat to any desired temperature, and allow it the necessary period of 'curing' before milling. . . .

"These experiments were conducted on a small scale. Investigations more nearly approximating commercial tempering conditions are needed to corroborate the results."

"The results show that it is entirely possible to treat new wheat with moisture and heat and bring about an improvement in the milling quality similar to the natural aging of the wheat. The results of the experiments on heating wheat show that the degree of heat used for destroying mill and stored-grain insects does not in any way injure the wheat or the flour."

From the results of experiments on the effect of germination of wheat, in which baking tests were made with blended flours containing varying percentages of flour from germinated wheat, it is concluded that "the claims made in regard to the damage upon the milling and baking quality of wheat and flour from such wheat, when mixed with sound wheat, have been much exaggerated. Germination injures the milling quality of the wheat in that the flour yield is less and the flour is likely to have an inferior color. The injury is in proportion to the amount of germination. The gluten of flour from germinated wheat is weaker than the gluten from flour of sound wheat. A small amount of flour from germinated new wheat when mixed with flour from sound wheat has little or no deleterious effect on the baking qualities of the mixed flour when the same general methods of baking are followed as were used in these tests."

Digestion experiments with flour containing specially prepared bran, O. VON CZADEK (*Ztschr. Landw. Versuchsw. Oesterr., 18 (1915), No. 11, pp. 613–622*).—Bran prepared by the so-called Finkler process of milling, using special machinery in the presence of water containing lime and salt, was found to be exceptionally well utilized by the human body. Bread was made by the addition of 15 to 20 per cent of the finely milled bran to flour milled in the ordinary way, and this was eaten by two normal human subjects as a part of a simple mixed diet. The so-called "final" bread possessed a good taste and remained in a fresh and appetizing condition longer than ordinary rye bread. From the results of comparative digestion experiments the author concludes that bread made to contain from 15 to 20 per cent of bran has practically the same nutritive value as rye bread.

The preservation of corn meal, A. MARBACH (*Österr. Chem. Ztg., 18 (1915), No. 11, p. 96*).—In the author's opinion Indian corn meal can be preserved satisfactorily by germination previous to milling.

Indian corn for bread making, J. BRUDERLEIN (*Bul. Soc. Bot. Genève, 2. ser., 6 (1914), No. 5, pp. 139, 140*).—A preliminary report of experiments to utilize micro-organisms of the Mucor group as leavening agents for corn bread.

The nutritive value of whole Indian corn bread, F. RÖHMANN (*Berlin. Klin. Wchnschr., 53 (1916), No. 5, pp. 105, 106*).—A summary and digest of data concerning the advantages of milling the entire kernel of grain for use in human nutrition.

The use of durra in human nutrition, G. TROPEA (*Bol. R. Giard. Colon. Palermo, 2 (1916), No. 4, pp. 243–250*).—Analytical data are reported giving the comparative composition of samples of flour made from wheat, durra, feterita, and potatoes. In the author's opinion, durra possesses a nutritive value equal in some respects to wheat flour and infinitely superior to potato flour. The use of one part of durra flour to three parts of wheat flour is advocated for bread making.

Increasing the supply of bread materials, S. THIELER (*Centbl. Zuckerindus., 23 (1915), No. 20, pp. 457, 458*).—Baking experiments are described from which the author concludes that raw beet sugar and sugar-beet flour may both be used as additions to rye flour for bread making. The bread is said to be palatable, satisfying, and of good keeping quality.

The estimation of potatoes in war bread, W. HERTER (*Chem. Ztg., 39 (1915), No. 88–89, pp. 555, 556*).—The percentages of potato starch found in several samples of war bread are reported.

Experiments with straw bread, G. WÖLLSTÄDT and W. KLEBERGER (*Fühling's Landw. Ztg., 65 (1916), No. 1, pp. 27–32*).—Baking tests are described with mixtures of varying proportions of rye flour and finely milled oat straw. The bread was heavy and unsatisfactory. Digestion experiments of six weeks' duration also indicated that straw bread is an undesirable food, as evidenced by the facts that physiological disturbances were noted and the subjects (men) lost weight.

Concealing the use of blood in bread, R. DROSTE (*Chem. Ztg., 39 (1915), No. 100–101, p. 634*).—The use of hydrogen peroxid instead of yeast or baking powder is advocated for making bread to which blood is added. The oxygen which is set free both raises and bleaches the bread. The blood should first be kept in a refrigerator for from 24 to 36 hours, after which the serum is filtered off and added to the dough.

Skim milk and potatoes as a meat substitute, T. PFEIFFER (*Wiener Landw. Ztg., 65 (1915), No. 46, pp. 366, 367*).—Data are given showing the economy that may be effected by the use of skim milk and potatoes as a meat substitute. The protein content and calorific value of 4.5 liters of skim milk and 1.1 kg. of potatoes, it is stated, are equal to those of 1 kg. of beef.

Examination of Scallops, A. L. SULLIVAN (*Amer. Food Jour., 10 (1915), No. 9, pp. 472, 473*).—Analytical data are reported from which the author concludes that the practice of soaking scallops lowers the food value of the product and makes the consumer pay for a large excess of water.

Hydrocarbons in fish-liver oils, H. MASTBAUM (*Chem. Ztg., 39 (1915), No. 139–140, p. 889*).—The author noted that certain fish-liver oils contained from 80 to 90 per cent of unsaponifiable oil. He considers the presence of mineral-like oils in fish of particular importance as evidence in support of the theory that the deposits of mineral oils on the earth originated from fish residues.

Sources of fat, O. NEUSS (*Umschau, 19 (1915), No. 49, pp. 965–967, fig. 1*).—The author describes some comparatively uncommon sources of edible fat which

may be utilized if necessary. Among these are hemp, poppy, and mustard seeds, hazel and beech nuts, and the stones of certain fruits like the peach.

The utilization of fruits and vegetables, KOCHS (*Landw. Jahrb., 46 (1914), Ergänzungsb. 1, pp. 45–50, figs. 2*).—In this report directions are given for the preparation of a number of fruit and vegetable products, among them rhubarb juice, rhubarb-apple jelly, jelly from Japanese quinces, and some banana preparations.

Losses and other chemical changes in boiling vegetables, KATHARINE I. WILLIAMS (*Chem. News, 113 (1916), No. 2940, pp. 145–147*).—A summary and digest of data, most of which has been noted from other sources.

Nutritive yeasts as food, P. SCHRUMPF (*München. Med. Wchnschr., 63 (1916), No. 8, pp. 269, 270*).—A summary and digest of data.

Effect of storage on moisture content of cloves, A. W. OGDEN (*Amer. Food Jour., 10 (1915), No. 9, p. 474*).—The average loss in weight of whole cloves during storage was found to vary from 2.42 per cent for a 6 months' period to 4.7 per cent for a period of 54 months.

The influence of the seasons on the toxicity of egg albumin fed to white rats, F. MAIGNON (*Assoc. Franç. Avanc. Sci., Compt. Rend., 43 (1914), pp. 553, 554*).—In the experiments here reported the animals fed during the winter on egg albumin with the addition of mineral salts died in about three weeks with a loss of more than 40 per cent of their body weight. Similar experiments in spring and autumn resulted in the death of the animals in three or four days with the loss of only 20 to 22 per cent of their body weight; these animals appeared to have died of nitrogen intoxication. It is suggested that the frequency of certain epidemics in spring and autumn may be due to a lowered resistance of the organism at that time and greater sensitiveness to nitrogen intoxication.

Is it hygienic to use apricot and peach kernels in the preparation of marchpane? K. B. LEHMANN (*Chem. Ztg., 39 (1915), No. 91–92, pp. 573–575*).—Analytical data are given comparing the amounts of the bitter principle in the apricot, peach, and almond. The author concludes that apricot and peach kernels may be used in the place of almonds for confections, provided they are soaked in water at 50° C. (122° F.) for several hours to reduce the benzaldehyde content below 40 mg. per 100 parts of the confection.

The presence of tin in canned foods, P. CARLES (*Ann. Chim. Analyt., 20 (1915), No. 10, pp. 216–219*).—The quantity of metal dissolved from tin containers is said to vary according to the amount of sodium chlorid present, the acidity of the medium, the surface area of the exposed tin, and the duration of contact.

[Food and drug inspection], F. H. FRICKE (*Ann. Rpt. Food and Drug Comr. Missouri, 1915, pp. 59*).—The report of the state chemist, H. E. Wiedemann, contains the results of the examination of 1,259 samples of foods, of which 1,000 were found to be in accordance with existing standards. The reports of the state inspectors contain the results of sanitary inspections of groceries, bakeries, and other establishments where foods are prepared and sold.

[Food and drug inspection and analysis], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul., 4 (1916), No. 2, pp. 33–64*).—This bulletin reports the results of the inspection of a number of restaurants, hotel kitchens, bakeries, confectionaries, meat markets, and slaughterhouses, made in various parts of the State during the year 1915, the score of each place inspected being given. The results of the examination of a few samples of foods and drugs, including toilet soaps, are also reported.

Twelfth annual report of the food commissioner and state chemist, E. F. LADD ET AL. (*North Dakota Sta. Rpt. 1915, [pt. 2], pp. 25*).—The work carried

on under the state food and drug laws during the fiscal year ended June 30, 1915, is summarized briefly. Miscellaneous information regarding pure food topics, food standards, and definitions being included.

National Association of Master Bakers (*Nat. Assoc. Master Bakers [Proc.], 18 (1915), pp. 189, figs. 21*).—In addition to the report of the business transacted during the convention a number of addresses are reprinted, among them the following: The Effects of the Mineral Salts Contained in Natural Waters upon the Fermentation of Bread, by H. A. Kohman; Flavor in Bread, by A. C. Junge; How the State University Can Help the Baker, by R. M. Allen; and Mill Streams and Commercial Flours, by L. A. Fitz.

A scale for marking nutrition, F. A. Manny (*School and Soc., 3 (1916), No. 56, pp. 123, 124*).—The scale discussed here is the one used by the Bureau of Child Hygiene for the examination of children in the New York City schools.

Food for young children, Caroline L. Hunt (*U. S. Dept. Agr. Farmers' Bul. 717 (1916), pp. 20, figs. 4*).—This publication is written especially for mothers and contains a short discussion in simple terms of the food requirements of children between the ages of 3 and 6 years. The foods making up the diet are classed in five groups, as follows: Milk and other protein foods; bread and other cereal foods; butter and other wholesome fats; vegetables and fruits; and simple sweets; and it is stated that a child should receive at least one food from each of these groups every day. Recipes and suggestions for the preparation of the foods in each group are given.

The feeding and care of the baby (*Bul. Bd. Health Maine, 4 (1916), No. 2, pp. 40*).—A popular bulletin containing information regarding breast and bottle feeding, diet during the second year, and the general care of the baby.

Casein-milk feeding in infancy and childhood, W. Gellhorn (*Jour. Amer. Med. Assoc., 65 (1915), No. 10, pp. 853–855*).—Data comparing the composition of casein milk and other milks are reported together with a number of clinical observations, from which the author concludes as follows:

"Casein-milk feedings have been found to be successful as temporary food in allaitement-mixte and whenever it was necessary to wean a very young child abruptly. Although they do not seem to produce any harm during prolonged use, the advantages they offer are not sufficiently clear to recommend their substitution for the ordinary milk modifications in normal children.

"They can not replace breast milk in some of the severest cases, but in the great majority of nutritional disturbances, as seen in private practice, they will be found to be of assistance. They are indicated in disorders of a fermentative origin, and can be fed here in rapidly increasing doses, regardless of the stool picture, provided the child does not develop symptoms of alimentary intoxication. Through their use may be avoided the prolonged or repeated therapeutic hunger periods with their deteriorating influence on the child's organism, which are so frequently the cause of turning an originally mild into a serious disorder."

The mineral nutrients in practical human dietetics, E. B. Forbes (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 123–128*).—In this article considerable important information is brought together regarding the minerals supplied to the body by different food materials.

In discussing the general mineral requirements of the body the author takes up certain special phases of the question, among them the mineral requirements of infants, including infant diseases due to mineral supply and the mineral requirements during periods of growth, reproduction, and old age. It is pointed out that liberal and diverse diets are most likely to supply a sufficient quantity of each of the minerals, and that "the central features of improperly chosen diets are usually an undue dependence upon meats and foods made from finely

milled cereals or other cereal foods lacking the outer seed coats and too little use of milk and vegetables."

Fluorin in the vegetable kingdom, A. GAUTIER and P. CLAUSMANN (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 3, pp. 105–112*).—Analytical data are given showing the quantities of phosphorus and fluorin found in many different kinds of vegetables. The following amounts of fluorin, in milligrams, were found present in 100 gm. of the dry substance: The pulp of apple, 0.21; the skin of apple, 2.78; the pulp of banana, 0.38; the skin of banana, 5.1; wheat flour, 1–1.41; rye flour, 0.6; buckwheat flour, 2.53; barley, 2.2; rice, 0.94; white beans, 2.1; lentils, 1.8; mustard, 1.58; chocolate, 1.78; and green coffee, 1.45.

Further studies of nitrogen metabolism, E. ABDERHALDEN (*Hoppe-Seyler's Ztschr. Physiol. Chem., 96 (1915), No. 1–2, pp. 1–147*).—The results are reported of an extensive investigation of the nutritive value of amino-acid mixtures, some of which were derived from naturally occurring protein and some from sources foreign to animal tissue. The biological value of tryptophan, tyrosin, phenylalanin, and other amino acids was studied, and also the influence of the ingestion of potassium nitrate, ammonium salts, urea, and sodium acetate upon nitrogen metabolism. Numerous feeding experiments were conducted with laboratory animals (rats). For details of the investigation the original should be consulted.

The influence of the amino acids on the pancreatic secretion, S. KOBZARENKO (*Internat. Beitr. Path. u. Ther. Ernährungsstör. Stoffw. u. Verdauungskrank., 5 (1915), No. 4, pp. 434–457*).—Feeding experiments with laboratory animals (dogs) are described, in which mixtures of amino acids prepared from various sources were ingested and the resultant effects on the pancreatic secretions studied. An extensive bibliography is appended.

The influence of protein feeding on the elimination of creatin in starvation, W. C. ROSE (*Jour. Biol. Chem., 20 (1915), No. 4, Proc., p. XIX*).—Experiments with normal men indicate that the feeding of large amounts of protein causes a marked diminution in the creatin elimination during starvation. As this is not true in severe cases of diabetes or in depancreatized dogs, the author concludes that the disappearance of creatin from the urine, following protein feeding, is due to the carbohydrate metabolized from protein.

The excretion of creatin during a fast, F. D. ZEMAN and P. E. HOWE (*Jour. Biol. Chem., 20 (1915), No. 4, Proc., p. XVIII*).—The determination of creatin in the urine of a fasting man throughout a 7-day fast showed that creatin was excreted on each fasting day in amounts comparable in most cases with those obtained in previous fasts under similar conditions.

The synthetic capability of the animal body, W. STEPP (*Ztschr. Biol., 66 (1916), No. 8, pp. 350–358*).—From the experimental data herein reported the author concludes that the bird and animal organisms differ, in that the body of the pigeon can do without lipoids in the diet, though not without vitamins, while the animal organism requires both of these food constituents.

Is the nutritional disease produced by lipoid starvation identical with beri-beri? W. STEPP (*Ztschr. Biol., 66 (1916), No. 8, pp. 339–349*).—In a series of feeding experiments with laboratory animals (mice) the effect of ingesting diets deficient in either vitamins or lipoids was studied.

The conclusion is drawn that a lipoid-free diet can be made complete only by the addition of lipoids, and that it can not be made sufficient by supplying other accessory nutrients such as vitamins. Similarly, a vitamin-free diet can be made sufficient only by the addition of vitamins.

Diet and pellagra. Rabbits and hares as a possible dietary factor in combating the disease, C. W. STILES (*Pub. Health Rpts. [U. S.], 31 (1916), No. 13, pp. 817, 818*).—The author suggests the possibility of the use of rabbits and

hares as a supply of meat in districts where pellagra is prevalent and where a supply of beef, mutton, etc., is not available.

The content of some digestive ferments in the feces, H. A. Kurschakow (*Internat. Beitr. Path. u. Ther. Ernährungsstör. Stoffw. u. Verdauungskrank., 5 (1915), No. 4, pp. 511–527*).—Clinical observations and analytical data are reported concerning the occurrence of digestive ferments in the feces under both normal and abnormal conditions. A bibliography is appended.

Sense impression and appetite, W. Sternberg (*Internat. Beitr. Path. u. Ther. Ernährungsstör. Stoffw. u. Verdauungskrank., 5 (1915), No. 4, pp. 421–433*).—In this article are discussed the factors which influence appetite. The fuel value of the diet and the nutritive value of the food are not deemed the only considerations in planning the dietary. The author is of the opinion that appetite is not a function of the stomach or the digestive glands, but that it is influenced principally by the senses of sight, taste, smell, and touch—that attractiveness for the senses stimulates appetite.

The calorimeter as the interpreter of the life processes. A study of the fuel requirements of the human individual, G. Lusk (*Sci. Amer. Sup., 81 (1916), No. 2097, p. 171*).—In this treatise the author summarizes a great deal of experimental data, most of which has been noted from the original sources.

ANIMAL PRODUCTION.

Units of reference for basal metabolism and their interrelations, C. R. Moulton (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 299–320, figs. 21*).—This is a further discussion of work previously reported (E. S. R., 33, p. 569).

"A simple relation has been shown to exist between the total body nitrogen and the fat-free empty weight of beef cattle. A simple relation exists also between blood weight and fat-free empty weight or between blood weight and total body nitrogen. The surface area of beef cattle is a power function of the warm empty weight, the formula for fat animals being $A=0.134\ W^{\frac{5}{8}}$ and for other animals $A=0.1186\ W^{\frac{5}{8}}$. The surface area is also a power function of the fat-free empty weight. The formula for all animals is $A=0.1034\ W_1^{\frac{3}{4}}$. The surface area is a power function of the total body nitrogen, the formula being $S=N^{\frac{3}{4}}$. The body surface and total blood are related in a similar manner, the formula being $S=0.8\ B^{\frac{5}{8}}$.

"Since these relations have been shown to be fairly constant for animals under different conditions it would seem to make little or no difference what unit of reference is used as a measure of basal metabolism as long as the unit used has been actually measured. It would seem also that for beef cattle the desired unit of reference could be calculated with considerable accuracy if the fatness of the animal and its condition with regard to fill can be determined. In many cases, however, the amount of fill in the beef animal can be disregarded. The author has shown average variations in fill of from 2 to 4 per cent of the live weight for mature animals."

The energy consumption increases with the body weight, but not proportionally, and there are large variations. The variations in the heat consumption per kilogram of body weight are great, a 500-kg. steer consuming from 25 to 35 calories per kilogram. There is a marked tendency for the consumption of energy per kilogram to decrease with increasing weight. The variations from the average are 23.5 per cent. A tendency is also shown for the heat consumption per unit of surface area to increase as the body weight increases. This has been found to be due to the greater weight sustained by the animal

while standing and walking, the energy required for this being proportional to the weight sustained. The heat consumption per kilogram of body nitrogen is quite uniform, the extreme variation being 14 per cent of the average. The tendency is for a slight decrease in this consumption per unit of blood as the animal gets heavier, an extreme variation of 15 per cent from the average being shown.

"The smallest variations are shown in the heat consumption per unit of body surface and the greatest variations in the heat consumption per unit of body weight. Per unit of body nitrogen (protoplasmic tissue) and per unit of blood the variations are not much larger than per unit of body surface. If there is a choice of units it would seem to fall upon the surface area. Since this can easily be calculated from the body weight by the formulas proposed by the writer of this paper it would seem that this unit fits well the needs of the investigator in animal nutrition, especially with beef cattle. These conclusions are opposed to the views of Benedict [E. S. R., 33, p. 264] but are in agreement with those of Du Bois [E. S. R., 34, p. 68] and Graham Lusk."

Experimental studies on growth.—I, Methods, T. B. ROBERTSON and L. A. RAY (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 347–361, figs. 3*).—Methods employed in experiments on the growth of mice are described by which the animals may be maintained in good health and as free as possible from zymotic disease and other deleterious factors in the environment which might conceivably exert an effect upon their growth. Improved forms of cages, food receptacles, and nest houses are described.

Rapid methods of handling and weighing large numbers of animals, and a balance especially adapted to this purpose, are also described.

A further analysis of the hereditary transmission of degeneracy and deformities by the descendants of alcoholized mammals, II, C. R. STOCKARD and G. PAPANICOLAOU (*Amer. Nat., 50 (1916), No. 591, pp. 144–177, figs. 7*).—The results of experiments covering a period of five years have demonstrated on two different stocks of normal guinea pigs that "the parental germ cells may be so modified by chemical treatments that they are rendered incapable of giving rise to a perfectly normal offspring. This incapacity is probably due to modifications of the chromatin or carriers of the hereditary qualities within the germ cells, since the great-grandchildren, the F_3 generation, from the treated animals are usually more decidedly affected and injured than the immediate offspring (F_1) of the alcoholized animals. . . .

"The treatment of adult guinea pigs by an inhalation method with daily doses of alcohol through several years produces little if any noticeable effect upon the organs and tissues of the animal's body. The direct action of alcohol fumes tends to injure the respiratory mucosa and to render the cornea of the eye dull or opaque. These changes, however, do not inconvenience the animals in any perceptible way, and they remain strong and hardy and live as long and actively as the untreated guinea pigs.

"In spite of their healthy appearance the injurious influence of the alcohol inhalation is very decidedly shown by the quality of offspring to which the treated animals give rise. And the descendants of these offspring are even worse than the F_1 generation when compared with the different generations of control animals produced under identical cage and food conditions. The males seem to be more injured by the treatment than the females, taking as an index of injury the quality of their offspring and descendants. Stating it differently, the spermatocytes or spermatozoa are more sensitive to the changed chemical condition of the tissues than are the female germ cells. There is a larger proportion of degenerate, paralytic, and grossly deformed individuals descended from the alcoholized males than from the alcoholized females.

"Inbreeding tends to emphasize the alcoholic effects. This is probably due to related animals responding to the treatment in closely similar ways on account of the similarity of their constitutions. Inbreeding, as such, may be harmful. But inbreeding added to the alcohol effects produces a much worse condition in the offspring than either inbreeding or alcoholism alone could do. The data from alcoholized male lines indicate that the female offspring from alcoholic males are less viable and more frequently deformed than the male offspring. And heterogeneous matings of such male and female offspring further emphasize the same inferiority on the part of the female offspring from treated males. . . . The data from alcoholic female lines indicate that the male offspring from alcoholic females are inferior in quality to the female offspring. And heterogeneous matings of such male and female offspring further prove the inferiority on the part of the male offspring from treated mothers. . . .

"The experiments show the hereditary transmission through several generations of conditions resulting from an artifically induced change in the germ cells of one generation. And they furnish data of importance bearing upon the pathological behavior of the carriers of heredity as well as the differences in behavior between the two types of germ cells produced by an animal carrying heteromorphic chromosomes."

A list of references relating to the literature cited is included.

Composition, nutritive, and manurial values of various farm foods, C. Crowther (*Univ. Leeds and Yorkshire Council Agr. Ed.* [*Pamphlet*], *73* (*1916*), *3. ed., folio*).—The composition and nutritive value of the following feeding stuffs is given: Egyptian and Bombay cotton-seed cakes; linseed, hemp-seed, rape, peanut, coconut, palm-kernel, and soy-bean cakes; soy beans; flaxseed; dried yeast; locust beans; wheat middlings, sharps, and bran; oatmeal; maize-germ meal; gluten meal; gluten feed; rice meal; malt; malt dust; wet brewers' grains; dried brewers' grains; dried distillers' grains; molasses; meat meal; fish meal; wheat; barley; oats; rye; maize; beans; peas; wheat, barley, rye, oat, bean, and pea straws; meadow hay; "seeds" hay; pasture grass; clover; vetches; alfalfa; cabbage; rape; turnip tops; turnips; swedes; mangels; carrots; sugar beets; potatoes; whole, skim, and separated cow's milk; whole, skim, and separated ewe's milk; whole, skim, and separated mare's milk; and whey.

Ensilage of fresh turnip leaves, H. Åkerberg (*Tidsskr. Norske Landbr.*, *22* (*1915*), *No. 8*, *pp. 348–354*).—The leaves are placed on loose sandy soil in a ditch 6.5 meters (21.33 ft.) long, 2 meters wide at the bottom and 3.3 meters at the top, 1.2 meters deep, and holding 16,000 kg. (over 17.5 tons) of fresh turnip leaves. The ditch is lined at the bottom with boards and the sides covered with a thin layer of straw, protecting the leaves from being soiled by earth. The leaves should be as fresh as can be obtained and receive hard daily packing.

The best temperature for a good silage is from 30 to 45° C. (76 to 113° F.). Should the temperature not rise to 30°, it is necessary to wait before adding more leaves; should it reach 45°, or threaten to rise above it, it is necessary to put fresh leaves on as fast as possible and to pack them down hard.

When the leaves are well packed the heap settles slowly, and when the temperature falls to 30° it is first covered with a thick layer of straw, which in its turn is covered with earth to prevent the access of air to the silage. After a few days the temperature is taken, and should it have reached 40° or more, more earth is heaped over the first; but if 30° or less it should be left as it is until the temperature reaches the desired degree. Care should be taken that the cover of earth be uniform. In taking the daily supply of silage no more than necessary of the earth and straw covering should be disturbed.

Exposure to the air darkens the silage. In changing the feed from roots to silage some care should be taken to accustom the cows to it gradually; later, good milch cows may be given 12 kg. a day, and ordinary and young animals 6 kg.

Cattle forms found in the environs of Börssum in the Duchy of Brunswick, L. Knoop (*Landw. Jahrb., 48 (1915), No. 5, pp. 791–803, figs. 6*).—This is a report of a study made of the skeletal measurements, dentition, and general conformation of the remains of certain prehistoric types of cattle found in the Duchy of Brunswick, Germany.

Color in cattle, W. Graham (*Live Stock Jour. [London], 83 (1916), No. 2188, pp. 177, 178*).—A general discussion of the physiological aspects of color in cattle.

Are sheep profitable in Maine? C. D. Woods (*Maine Sta. Bul. 246 (1916), pp. 30–36*).—This is an account of the expenditures incident to the care and management of an ordinary farm flock of grade Hampshire sheep consisting of 75 ewes, 55 lambs, and 3 bucks, for one year under Maine conditions. The cost of operation for the year was $1,306.63. The sales and inventory aggregated $1,048.67. The total loss without any consideration of overhead charges, depreciation of plant, rent of land, interest on investment, or taxes that a farmer would pay, was $257.76, or about $3.45 for each of the old ewes.

Sheep feeding trials at Williston Substation, W. H. Peters and C. H. Ruzicka (*North Dakota Sta. Bul. 115 (1916), pp. 301–316, figs. 13*).—Two lots of range-grown Hampshire grade lambs were fed during the winter of 1914 for 103 days. Lot 1 of 50 lambs received no feed except good alfalfa hay, all they would eat; lot 2 of 220 lambs, alfalfa hay and a light grain ration composed of elevator screenings for the first one-third of the period and corn and barley for the remaining two-thirds of the time. The feeding of grain in addition to alfalfa hay practically doubled the gains for the entire period. The feeding of grain with the alfalfa increased the margin between the purchase price plus feed cost and the selling price from $1.21 for the alfalfa lambs to $1.76 for the alfalfa and grain lambs, or a difference of 55 cts. per head in favor of the grain feeding. The dressing percentage on the alfalfa and grain fed lambs was 53.1 per cent, and on the alfalfa-fed lot 50.3 per cent.

In a second trial a single lot of 210 lambs was fed during the fall, instead of the winter as in the first trial, for 75 days. They were allowed to run in a corn patch and later were turned into stubble fields, receiving in addition a light feed of alfalfa hay and a little grain. In November they were taken off the stubble and fed for a month a heavy grain feed consisting mainly of barley together with some refuse grain and soft corn. These lambs made an average daily gain per head of 0.29 lb. and realized a profit of $1.72 per head. The grazing on corn and stubble proved successful and aided considerably in keeping down the cost of grain for the entire feeding period. Thirty-five days of hay and grain feeding at the close of the stubble season was sufficient to put the lambs on the market as choice butcher lambs in good killing condition.

In comparing the gain made by small and large lambs it was found that the former made the greater percentage increase by 10.17 per cent. However, when placed on the market the 15 large lambs sold at 8.65 cts. per pound and the 15 small ones at 8 cts. This fact would indicate that the small lambs, if one were buying a carload of them, would have to be bought at a lower price per pound than the large ones if as much profit were to be made in feeding them. In this trial it would have been necessary to purchase them at least 0.6 to 0.75 ct. per pound cheaper.

Suffolk sheep and what they mean (*Live Stock Jour. [London], 83 (1916), No. 2188, p. 179*).—A study of the breed characteristics and utility value of the

Suffolk breed of sheep, and the possibility of their introduction into Canada, Australia, Argentina, New Zealand, and other places.

The sheep in Egypt, G. C. DUDGEON and MOHAMMAD 'ASKAR (*Agr. Jour. Egypt, 5 (1915), No. 1–2, pp. 31–45, pls. 8*).—A discussion of the breed characteristics, distribution, and utility value of the various breeds of sheep native to Egypt.

Inheritance of fertility in swine, E. N. WENTWORTH and C. E. AUBEL (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 25, pp. 1145–1160, figs. 4*).—The authors summarize the results of their studies at the Kansas Experiment Station as follows:

"Fertility in swine offers favorable material for the study of quantitative inheritance, because the units of deviation are discrete. Biometric studies of litter size with mother and daughter have indicated a small degree of inheritance. Crosses of breeds having different mean litter sizes have suggested that segregations of fecundity factors may take place. Numerous nongenetic factors limit the full expression of the inborn possibilities of fertility. Certain few somatic characters may be correlated either in a physiological or genetic manner with the different degrees of fecundity, but the bulk of characters usually assumed to be so related are probably entirely independent of it. Herdbook data on the fertility of swine present sources of error, but the percentage of error is low enough to permit the statistics to be suggestive.

"Numerous influences exist which lower the size of litter, which sources of error may operate in a manner compensatory to those just mentioned. It is questionable whether the size of litter represents the hereditary factors transmitted, but the somatic character was perforce accepted at face value in these studies. There is no reduction in variability in the litter sizes of the dams as compared with the grandparents or progeny, as would result if there were homozygous differences for fertility in the grandparents. Hence, the fertility deviations are either nongerminal or else the degree of heterozygosis is so great in the grandparents that no increased variability in the F_2 generation is possible. The latter explanation is probably the correct one. The frequency curves for the 3,540 litters studied make it appear that there are at least three centers of deviation in swine fertility. These centers possibly correspond to genetic factors involved in the inheritance of fecundity."

A bibliography of literature cited is given.

Some hog raising experiments, W. A. LINKLATER (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 12, pp. 2–4*).—Twenty newly-weaned pigs were turned on clover May 3, and 10 more on May 17. These pigs were fed a pound each of mixed grain daily as a thin slop, this grain mixture consisting of ground barley, oat middlings, and oil meal, 3:3:1. The grain mixture was gradually increased until the seventh week, after which time the pigs were fed 1¾ lbs. each per day. The pigs apparently did not care for the clover pasture, but gained 0.27 lb. each, daily, and required 5.37 lbs. of grain, plus the clover pasture, for each pound of gain. On July 24 the pigs were turned into grain fields of winter wheat and field peas, and had hogged off the grain clean by September 16. In that time they had gained 1,676 lbs. or a little over 1 lb. per pig per day. It is estimated that they required 3.58 lbs. of grain to produce 1 lb. of gain.

The pigs were then divided into 5 lots of 6 pigs each and fed 38 days. Lot 1 received ground barley alone; lot 2 ground barley and tankage, 9:1; lot 3 ground barley and oil meal, 4:1; lot 4 ground barley and alfalfa meal, 4:1; and lot 5 ground barley and skim milk, 1:2.5. These lots made average daily gains per pig of 1, 1.2, 1.2, 1.1, and 1.4 lbs., consuming 4.54, 3.82, 3.7, 4.1, and 2.6 lbs. of grain per pound of gain for the respective lots. Lot 5 consumed, in addi-

tion, 6.5 lbs. of skim milk per pound of gain, but made the most economical gains. The addition of protein-rich feeds as a supplement to ground barley effected a considerable saving in the amount of grain required per pound of gain.

Successful experiments are reported in feeding roots, particularly mangels, to brood sows, from 15 to 20 lbs. of raw mangels and 1 lb. of grain being fed daily. The results of hogging off mangels, ruta-bagas, kale, and rape are given, as furnished by a private farm in Washington. The hogs relished the mangels best, the ruta-bagas being eaten less readily. The hogs did not do so well on rape as they did on kale, but this was thought to be due to the dried condition of the rape.

The hogs on half rations of ground barley ate much larger quantities of roots and forage than those on a full ration, though they made only about half as large gains. Two lots of hogs on the mangels had the same acreage each and the same tonnage of mangels, approximately, but those on the half rations of grain had their mangels all eaten in 19 days, while the full-ration hogs were put back on their field again and required 11 days longer to clean up all their mangels. All the hogs on full feed were in good condition for slaughter at the conclusion of the experiment; the others were not.

Swine feeding experiments comparing skim milk, blood-grain meal, and fat-free fish-feed meal for young swine, KLEIN (*Milchw. Zentbl., 44 (1915), No. 6, pp. 81–86*).—Three lots of pigs fed a basal ration of skim milk, barley, barley bran, and potato flakes, lot 2 receiving a blood-grain feed, and lot 3 fish meal in addition, made average daily gains per head per day of 0.397, 0.379, and 0.37 kg., demonstrating that these supplementary feeds have little value when skim milk forms a part of the basal ration.

Successful swine rations for the corn belt, J. M. EVVARD and W. H. PEW (*Iowa Sta. Circ. 26 (1916), pp. 3–15, figs. 8*).—This circular gives suggestive rations for fattening hogs, breeding sows, and suckling sows under both dry-lot and forage-feeding conditions.

Stallion enrollment.—IV, Report of stallion enrollment work for year 1915 with lists of stallions and jacks enrolled, H. E. MCCARTNEY (*Indiana Sta. Circ. 53 (1916), pp. 238, pl. 1*).—This is a report of stallion enrollment work for the year 1915, with lists of stallions and jacks enrolled.

Spotted asses, A. E. JENKS (*Jour. Heredity, 7 (1916), No. 4, pp. 165–168, figs. 2*).—It is stated that while piebalds are common among most domesticated animals the ass, like the camel and elephant, rarely has spots. However, instances of the kind are cited and it is thought that selective breeding is largely responsible for this albinism.

Bacterial infection of hen's eggs, A. POSTOLKA (*Wiener Tierärztl. Monatsschr., 3 (1916), No. 1, pp. 3–11*).—Out of 144 eggs examined 35 were found to be bacterially infected. The principal bacteria found were *Bacillus mesentericus vulgatus, Staphylococcus pyogenes aureus, B. subtilis,* and *B. megatherium.*

Care and management of baby chicks, MR. and MRS. G. R. SHOUP (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 12, pp. 11–16*).—General methods for handling baby chicks for the first eight weeks are given.

DAIRY FARMING—DAIRYING.

The succulent feed supply, E. B. STOOKEY (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 12, pp. 8–11*).—Five plans for supplying succulent feed for the dairy farm the year round are given. In two of these the silo is

made use of, two depend on pasture and soiling crops, and one depends very largely on pasture.

Report of the first Jersey sires' futurity test of the Aroostook Jersey Breeders' Association, R. PEARL (*Maine Sta. Bul. 247 (1916), pp. 37–52*).—It is stated that the idea underlying the inauguration of the sires' futurity test was that the surest indication that anyone can have of the breeding worth or value of an animal lies in the performance of its progeny. The first sires' futurity test of the Aroostook Jersey Breeders' Association was held at Aroostook Farm, Presque Isle, Maine, November 15, 1915, under the auspices of the station. Rules and methods of conducting the test are given, together with the results in milk and fat production in the 1915 test.

Finding the prepotent sire, J. M. HOVER (*Jour. Heredity, 7 (1916), No. 4, pp. 173–178*).—The author concludes from the study of the Guernsey advanced register that "marked prepotency is limited to a comparatively few animals; strongly prepotent sires usually belong to prepotent families or strains; prepotency is probably enhanced by inbreeding; prepotency may become a valuable aid to intelligent selection in breeding for greater production."

The causes of the beginning of milk secretion, H. MÖLLGAARD (*Mælkeritid., 28 (1915), No. 7, pp. 121–139, fig. 1*).—As a result of his studies the author concludes that in the preparatory growth of the milk gland in young female animals during their first pregnancy chemical substances are secreted in the ovary. The lacteal gland during pregnancy secretes during its latter half of development certain chemical substances, apart from the progeny itself, which go into the mother's blood. The beginning of milk secretion is intimately connected with the expulsion of the progeny, and possibly separates chemical compounds which emanate from the placenta. The influence of the hypophysis is deemed of considerable indirect importance in the secretion of milk.

The preservation of milk samples for investigational purposes, J. TILLMANS, A. SPLITTGERBER, and H. RIFFART (*Ztschr. Untersuch. Nahr. u. Genussmtl., 27 (1914), No. 12, pp. 893–901; abs. in Hyg. Rundschau, 26 (1916), No. 1, p. 21*).—Various methods of preserving milk samples are described.

Report of the committee on standard methods for the bacterial examination of milk, M. P. RAVENEL ET AL. (*Amer. Jour. Pub. Health, 5 (1915), No. 12, pp. 1261, 1262*).—Methods for the bacterial examination of milk as adopted by a committee of the American Public Health Association in September, 1915, are outlined.

Counting bacteria by means of the microscope, R. S. BREED and J. D. BREW (*New York State Sta. Tech. Bul. 49 (1916), pp. 3–31, pls. 2, figs. 5*).—This is a continuation of work previously noted (E. S. R., 31, p. 78). The present bulletin reviews and discusses the technique involved in counting bacteria in milk and other substances by means of a microscope, giving at the same time the results of studies which have been made in order to determine the sources and the amounts of the errors in counts made in this way.

"The results obtained from the examination of samples of milk collected in clean test tubes containing preservatives indicate that just as accurate counts of the number of bacteria present can be made from such samples as can be made if the samples are collected in sterile tubes and iced. Under certain conditions this method of collecting samples may become a great convenience. Capillary pipettes have been found to be more satisfactory for the measurement of 0.01 cc. quantities of milk than standardized wire loops. Faulty calibration of pipettes has been found to be a serious cause of error. Allowance must be made for the adhesion of a certain quantity of milk to the pipette if accuracy of measurement is to be secured.

"It has been found that sterilization of pipettes is an unnecessary refinement of technique and that a single pipette may be used for making preparations from a long series of samples, provided it is carefully cleaned in glass-cleaning solutions after each day's use and also cleaned by rinsing in fresh clean tap water after using in each sample and before passing to the next sample. Carelessness in cleaning pipettes causes marked errors in counts.

"Growth of bacteria has been found to take place in the drops of milk as they dry, so that it is important that these be prepared either from samples containing preservatives or that the milk be dried quickly. No growth was detected in the dried films even after incubation in a moist, 37° C. incubator for one to four days. The claim made by some that bacteria are removed when the fat drops are dissolved by solvents does not seem to have any foundation in fact. The dried milk solids-not-fat appear to act as a practically perfect fixative, no detectable mechanical loss of bacteria taking place when the fat drops are removed. On the other hand, serious errors in count are introduced where the bacteria are stained in the milk before the dried films are prepared, because in this way the bacteria are not always sufficiently stained to make it posssible to detect the full number present. Where the fat drops are left in the films, even though these be spread out so as to be in a very thin layer, they tend to obscure bacteria and so lower the count.

"The two essential conditions for making a reasonably accurate count of small objects, like bacteria, under a microscope are that the objects themselves be prepared in such a way that they are distinctly visible and recognizable and at the same time evenly distributed over the field of the microscope. These conditions are sometimes best secured in dried films, in other cases in liquid preparations. Microscopical methods of examining dried milk films are of value for two purposes: (1) They may be used for the rapid examination of milk in order to grade it according to its bacterial quality, both the number and the character of the bacteria present being taken into account. A microscopical examination permits a fairly accurate guess as to the probable plate count which will be secured from a given sample of milk. (2) They are also useful as research methods, the microscopical method being the only known method which permits a count of the number of individual bacteria. Microscopical counts of the number of isolated individual bacteria and compact clumps present in milk give figures which compare well with those obtained where Petri plate methods of counting are used."

Sources of bacteria in milk, M. J. PRUCHA (*N. Y. Produce Rev. and Amer. Cream., 41 (1916), No. 23, p. 925*).—A popular discussion of the work previously noted (E. S. R., 33, p. 876).

Butter fat investigation (*Georgia Sta. Rpt. 1915, p. 13*).—In preliminary work by F. H. Smith it has been found that cotton-seed oil may be detected in the butter made from cows fed cotton-seed meal within 12 to 36 hours after first feeding. From the time of the first appearance the test for cotton-seed oil became more pronounced, until the seventh day, when the influence of the oil appears to be at its maximum. After two, four, and six weeks continuous feeding of oil the effect is no more pronounced, in most cases even less, than at the end of the first week. When the oil is removed from the ration its effect apparently disappears within one or two weeks. The results would indicate that the oil is not transferred directly to the milk fat, but enters the milk fat only after it has undergone some change in the animal body.

The cheese value of milk of various compositions, E. HAGLUND (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 116 (1915), pp. 29; K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 7, pp. 583–609*).—Extensive experi-

ments were conducted to determine the value of different kinds of milk in the manufacture of cheese.

It was found that when the percentage of fat in the milk was increased, other conditions being the same, the absolute as well as the relative loss of fat in the whey was also increased, so that in the manufacture of cheese from thin milk a larger percentage of fat goes into the cheese than when it is manufactured from richer milk.

The poorer milk gives more cheese per pound of fat than does the richer. The loss of fat in the whey can not be lowered by using warm milk immediately after milking, but the use of milk greatly chilled increases the loss to a very small extent. The loss of fat in the whey is greater in the manufacture of large-eyed cheese than in that with small eyes.

The same relative quantity of nitrogen is lost in the whey regardless of the nitrogen content of the milk. When the content of nitrogen in the milk increases the content of casein nitrogen is also increased, but this does not prove a definite relation between the contents of casein nitrogen and total nitrogen.

Indol in cheese, V. E. Nelson (*Jour. Biol. Chem., 24 (1916), No. 4, pp. 533–536*).—In these studies, conducted at the Wisconsin Experiment Station, "indol and phenol were found to be present in Limburger cheese. Skatol was not found in Limburger cheese. Indol is present in handkäse. It is doubtful if skatol and phenol are to be found in this type of cheese. A trace of indol is present in Camembert cheese. Skatol and phenol are absent in this type of cheese. Cheddar, Swiss, gammalost, brick, and Roquefort do not contain any indol, skatol, or phenolic bodies. The amount of indol in a Limburger cheese naturally varies, depending upon how far the ripening process has gone. A young cheese may contain such a small amount that a quantitative estimation is impossible, while a good ripe Limburger cheese may contain as much as 1 part in 52,800 parts of cheese.

"Lactic and bulgaricus forms of organisms when grown upon media containing tryptophan produced no indol or skatol. As growing organisms upon pure amino acids is more difficult than upon proteins it may be necessary to add a little peptone or milk to the culture, and until further work has been done upon this phase it will be impossible to say that these organisms do not produce these putrefactive substances. The liquefying coccus isolated from a Cheddar cheese appears to produce traces of indol from tryptophan. If the experiments now in progress confirm this statement, then the explanation why no indol is produced by this type of organism in Cheddar cheese must be that conditions are unfavorable and growth is suppressed."

Study of the glycerin and lactic fermentation bacteria of cheese, Gerda Troili-Petersson (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 104 (1915), pp. 15; K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 1, pp. 30–42*).—The author states that three kinds of glycerin bacteria have been discovered by her in Swedish cheese. These bacteria coagulate the milk but do not form any eyes or gas bubbles.

Experiments made with several kinds of cheese showed that *Bacterium glycerini* (type *a*) forms, after long cultivation, gas in a lactose solution, while before cultivation it does not do so. It does not cause hydrolysis of fat. It is found in the Swedish-Swiss cheese, as well as in the Gouda and the Westbotten cheese (Västerbotten), and in greater quantity in the fresh cheeses than in the older ones. No change of taste could be detected when the *B. glycerini* was added to cheese milk under ordinary dairy conditions.

Several varieties of lactic fermentation bacteria were isolated from the abovementioned cheeses, but no quantitative difference in these was detected. The number of *B. acidi propionici* in cheese 11 months old with normal formation of

eyes was small, but in cheese with larger eyes the number was greater. Cheese containing a large percentage of saltpeter developed no fermentation when inoculated with lactic nutritive solutions.

Several tables are given which show the number of glycerin bacteria and of *B. acidi propionici* in the various kinds of Swedish cheese at various stages.

VETERINARY MEDICINE.

The principles of veterinary surgery, L. A. MERILLAT (*Chicago: Alexander Eger, 1915, 2. ed., rev. and enl., pp. 352, figs. 114*).—This volume is intended to meet the requirements of the student of veterinary medicine and of the practitioner. The second part (pp. 149–345) consists of a translation of Pathologie Chirurgical Generale, by LeBlanc, Cadeac, and Carougeau.

Biological therapeutics, A. EICHHORN (*Cornell Vet., 6 (1916), No. 1, pp. 5–24*).—A general review of the biological products in use as therapeutic and diagnostic agents.

Immunity: Methods of diagnosis and therapy and their practical application, J. CITRON, trans. by A. L. GARBAT (*Philadelphia: P. Blakiston's Son & Co., [1914], 2. ed., rev. and enl., pp. XVII+267, pls. 2, figs. 38*).—This is the second edition, revised and enlarged, of the work previously noted (E. S. R., 27, p. 76). Chapters on tumor studies and anaphylaxis have been added to the new edition and the subject matter of chemotherapy greatly elaborated.

A laboratory course in serum study, H. ZINSSER, J. G. HOPKINS, and R. OTTENBERG (*New York: The Macmillan Co., 1916, pp. XIII+184*).—This volume embraces a series of experiments and diagnostic tests in immunology carried out in an optional course given to medical and graduate students by the authors at Columbia University. Some of the subjects considered are immunization of animals; bactericidal and hemolytic power of normal serum; hemolysis; quantitative relations of amboceptor and complement; agglutinins and agglutination; precipitins; complement fixation; preparation for and technique of the Wassermann test; titration of an unknown antitoxin; animal toxins; antitrypsin; opsonins and titration of immune opsonins; and anaphylaxis.

Further researches on combined vaccines, A. CASTELLANI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 77 (1915), No. 1, pp. 63–73*).—This material has been previously noted from another source (E. S. R., 33, p. 477).

The origin of the antibodies of the lymph, F. C. BECHT and A. B. LUCKHARDT (*Amer. Jour. Physiol., 40 (1916), No. 2, pp. 366–371, figs. 3*).—From the investigation it is concluded that "the concentration of antibodies is greater in the serum than in the thoracic lymph, and greater in the thoracic lymph than in the neck lymph, not only in the actively immune animal but also in the passively immune animal; not only after equilibrium is established, but at the time when active exchange is occurring. The source of the antibodies of the lymph is the blood by direct exchange from that fluid. There is no evidence that antibodies originate from the tissues and are emptied into the lymph stream at the seat of formation."

Studies on the Abderhalden reaction, E. WEISE (*Arch. Hyg., 85 (1916), No. 2–3, pp. 61–116*).—From the investigation it has been demonstrated that specific ferments which cleave placenta protein can not be detected in the blood serum of pregnant swine, since such serum contains too many bodies which react with ninhydrin. The serum also shows no regularity in its action, the serum of nonpregnant animals very often cleaving placental substrate. The dialysis procedure for the determination of pregnancy in swine is, therefore, neither practicable nor reliable. In pregnant sheep and cattle placenta-protein-splitting ferments are very easily detected and are never found in nonpregnant

animals. The dialysis reaction, used in connection with clinical data, greatly facilitates the diagnosis of pregnancy.

For the determination of tuberculosis in cattle the dialysis procedure is a valuable diagnostic means, the number of failures being no larger than are yielded by the tuberculin reaction. Its practicability, however, should be further investigated.

The fixation of salvarsan and neosalvarsan by the blood after intravenous injection, W. J. YOUNG (*Biochem. Jour., 9 (1915), No. 4, pp. 479–484*).—It has been shown that "after intravenous injection of goats with salvarsan and neosalvarsan the serum contains arsenic in a form which can not be separated from the proteins by dialysis, and which is precipitated with the serum proteins by tannic acid. Salvarsan and neosalvarsan behave, therefore, in a similar manner to atoxyl. No such combination is obtained when inorganic arsenic is injected. This combined arsenic is found in the blood long after all free salvarsan and neosalvarsan have been eliminated. This combined arsenic is found in the plasma and in the red blood cells, but no trace of arsenic is retained in the fibrin."

Further investigations on the identification of anthrax by the precipitation method, SCHÜTZ and PFEILER (*Arch. Wiss. u. Prakt. Tierheilk., 41 (1915), No. 4–5, pp. 286–321*).—Experiments extending over a period of several years have demonstrated that anthrax can be easily diagnosed by the precipitation method. For the recognition of anthrax in cattle, horses, sheep, and swine, it is deemed the most reliable of all the methods in use.

The experimental results are submitted in tabular form.

Experiments in vaccination against anthrax, A. EICHHORN (*Jour. Amer. Leather Chem. Assoc., 11 (1916), No. 4, pp. 186–204*).—Previously noted from another source (E. S. R., 34, p. 579).

Proceedings of a conference to consider means for combating foot-and-mouth disease, held at Chicago, Ill., November 29 and 30, 1915 (*U. S. Dept. Agr., Proc. Conf. Combating Foot-and-Mouth Disease, 1916, pp. 157*).—A report of the proceedings of a conference which was called and presided over by the Assistant Secretary of Agriculture, C. Vrooman, who, in the opening statement, briefly reviewed the general situation.

The addresses delivered are as follows: The Application of Quarantine to Public Stock Yards and What Restrictive Measures Should Be Employed to Prevent the Infection of Such Yards Which So Far as Possible Shall Not Burden Traffic, by J. S. McFadyen (pp. 9–18); What Should Be Done to Improve the Control of Cleaning, Disinfection, and Movements of Stock Cars Used for Animals Originating in Quarantined Areas? by T. W. Tomlinson (pp. 18–28); An Ideal State Law for Cooperation Between State and Federal Authorities in Work of Eradicating Contagious Animal Diseases, by C. J. Marshall (pp. 29–38); What General and What Specific Rules Should Be Observed in Fixing the Periods and Duration of the Different Forms of Quarantine Against Foot-and-Mouth Disease? by V. A. Moore (pp. 39–46); The Need for Legislation Providing for Full Compensation, Effective Quarantine, and Saving Pedigreed Stock, by M. D. Munn (pp. 46–55); Economic Effect on Business Men as Well as Farmers of Temporary Outbreaks and of Permanent Presence of Live Stock Disease, by A. J. Glover (pp. 55–61); Remarks by Dr. J. G. Rutherford (pp. 62–67); discussions on losses from quarantine restrictions (pp. 67–78), probable origin of the outbreak (pp. 78–80), payment for losses in Illinois (pp. 80–82), and spread of foot-and-mouth disease by contaminated antihog-cholera serum (pp. 82–87); The Economic Importance to Stock Yards of the Eradication of Foot-and-Mouth Disease, by A. F. Stryker (pp. 87–89); Quarantine Zones or Units, by J. I. Gibson (pp. 89–106); The Cause of Foot-

and-Mouth Disease, by V. A. Moore(pp. 106–111); Disease Eradication and Live Stock Loans, by B. F. Harris (pp. 111–114); The Agricultural Press and Foot-and-Mouth Disease, by H. Wallace (pp. 114–132); Uniformity in Federal and State Laws and Regulations, by F. A. Balser (pp. 132–142); and Methods of Eradicating Foot-and-Mouth Disease, by J. R. Mohler (pp. 143–149).

Foot-and-mouth disease in man, R. L. SUTTON and A. O'DONNELL (*Jour. Amer. Med. Assoc., 66 (1916), No. 13, pp. 947–949, figs. 5*).—The history and pathology of a case of the disease in man are reported in detail.

Active immunization against glanders, A. MARXER (*Arch. Wiss. u. Prakt. Tierheilk., 41 (1915), No. 4–5, pp. 272–285*).—The earlier attempts of active immunization against glanders are reviewed and briefly discussed, and the author reports experimental results obtained by Levy, Blumenthal, and himself in which a suspension of bacteria killed by 80 per cent glycerol was used as a vaccine.

In the case of guinea pigs one large injection was sufficient to protect the animals against a subsequent infection. The same results were obtained with horses which, however, received two injections at an interval of two weeks.

Similar results were obtained using a vaccine prepared from bacilli killed with a solution of urea. This preparation has an advantage in that it can be preserved in powdered form, thus preventing a further attenuation of the bacilli, and can be easily prepared when desired for use. Actual field tests covering a period of four years, in which more than 1,000 horses were vaccinated, seemed to demonstrate conclusively the value of such a vaccine, especially where glanders is likely to be carried into noninfected regions.

See also a previous note by Levy et al. (E. S. R., 18, p. 773).

Leishmaniasis in animals, A. LAVERAN (*Ann. Inst. Pasteur, 28 (1914), Nos. 9–10, pp. 823–838; 11–12, pp. 885–912; 29 (1915), Nos. 1, pp. 1–21, fig. 1; 2, pp. 71–104, pls. 2, figs. 2; abs. in Jour. Compar. Path. and Ther., 28 (1915), No. 3, pp. 243–246*).—In this paper the author deals with the subject as follows: (1) Natural leishmaniasis in the dog; (2) infection set up experimentally with *Leishmania infantum;* (3) infections set up experimentally with *L. donovani;* and (4) natural and experimental infections with *L. tropica.*

The Negri bodies in some animals which hibernate and their relation to the Negri bodies of other animals, F. SANFELICE (*Ztschr. Hyg. u. Infektionskrank., 79 (1915), No. 3, pp. 452–491, pls. 4*).—The author reviews the literature on the subject, and discusses the course of rabies and occurrence of Negri bodies in the European hedgehog (*Erynaceus europæus*) and in the European dormouse (*Muscardinus avellanarius*), Negri bodies in some nonhibernating animals and in birds, and the origin of inclusion bodies.

Inhibitory properties of magnesium sulphate and their therapeutic application in tetanus, S. J. MELTZER (*Jour. Amer. Med. Assoc., 66 (1916), No. 13, pp. 931–934*).—The author briefly discusses the theory of the inhibitory properties of magnesium sulphate and describes the methods used in its administration in tetanus.

Tuberculosis in the dog and cat, W. R. BLAIR (*Cornell Vet., 6 (1916), No. 1, pp. 25–35, pls. 2*).—The author outlines in detail the symptoms and lesions of tuberculosis in the dog and cat, and reports nine cases in the dog, together with the autopsical findings. The use of tuberculin as a diagnostic agent in such animals is deemed by the author not to lead to any reliable conclusions.

Graphic charts (*Roy. Com. Tuberculosis, Final Rpt., II, App., 7 (1912), pp. 57, pls. 51*).—This report illustrates graphically some of the results of the investigations of the Royal Commission on Human and Animal Tuberculosis, from 1902 to 1910. Detailed references are made from the charts to previous

volumes of the report of the commission which describe the work in detail. See also previous notes (E. S. R., 26, p. 884; 30, p. 283).

Monascus purpureus not a causative factor in forage poisoning, L. R. Himmelberger (*Jour. Compar. Path. and Ther., 28 (1915), No. 3, pp. 185–190, fig. 1*).—Studies carried on by the author in connection with investigations previously noted (E. S. R., 34, p. 681) have led to the following conclusions:

"*M. purpureus* grown under laboratory conditions had no etiological significance in this outbreak of forage poisoning, since feeding large quantities over sufficient lengths of time did not produce the disease. We desire to present the evidence of the foregoing experiments as suggestive of the nonpathogenicity of *M. purpureus* when fed in large quantities and when the products of its metabolism are injected intravenously.

"*M. purpureus* isolated from oats which had undoubtedly given rise to forage poisoning in horses and mules did not produce soluble or extracellular toxins in vitro on the cultural media employed, as shown by absence of clinical symptoms in the experimental animals."

Investigations on the intestinal flora of healthy oxen, A. Fischer (*Centbl. Bakt. [etc.], 1. Abt., Orig., 77 (1915), No. 1, pp. 6–39, fig. 1*).—The intestinal flora in mature animals, in calves from three to five months old, and in fasting calves (from a few hours to several days old) were studied. The effect on the flora of pasture feeding, winter feeding, and milk feeding was also studied.

The cultural, morphological, and biochemical characteristics, together with the pathogenicity, in some cases, of 38 organisms isolated are submitted.

A bibliography is appended.

Contagious abortion in cattle in Rhodesia, L. E. W. Bevan (*Jour. Compar. Path. and Ther., 28 (1915), No. 2, pp. 97–104*).—A report of investigations of this disease which have been carried on in Rhodesia, where cases of abortion in domestic stock have been reported from time to time during the past ten years.

Coccidiosis in cattle and carabaos in the Philippine Islands and its relation to rinderpest, C. H. Schultz (*Jour. Amer. Vet. Med. Assoc., 48 (1916), No. 6, pp. 687–705*).—Substantially noted from another source (E. S. R., 33, p. 482).

The distribution and abundance of the ox warbles, Hypoderma lineata and H. bovis, in the United States, F. C. Bishopp (*Ann. Ent. Soc. Amer., 8 (1915), No. 4, pp. 359–364, fig. 1*).—*H. lineata* is said to occur in every State in the Union, although there is considerable difference in its abundance in different sections. *H. bovis* is rather widely distributed through the northern part of the United States, the Northeastern States having by far the greatest infestation, and it predominates over *H. lineata* in both distribution and abundance. In the western two-thirds of the country it is found in rather restricted and well-separated areas. A map is given which shows the distribution of both species in the United States, based upon collections made during the course of the investigation.

The treatment of Johne's disease, J. M'Fadyean, A. L. Sheather, and J. T. Edwards (*Jour. Compar. Path. and Ther., 28 (1915), No. 3, pp. 196–216, figs. 9*).—"In many cases of Johne's disease treatment with ferrous sulphate is followed by improvement, the diarrhea being checked and the loss of condition arrested. In the majority of such cases the improvement is not very great and the disease soon resumes its ordinary course. In some cases the treatment fails to effect even a temporary improvement or to check the diarrhea and loss of condition. In a minority of cases the treatment has surprisingly beneficial results, suggesting even a complete cure, with disappearance of the diarrhea and restoration of the animal from a state of emaciation to excellent condition. Even in the last class of cases a relapse which does not yield to a repetition

of the treatment is likely to occur, and it is doubtful whether the treatment ever effects an absolute cure. In view of its uncertainty and of the slow recovery of weight in the most favorable cases, treatment can not be advised except in special circumstances.

"As a rule the most economical plan is to destroy the subjects of Johne's disease as soon as the disease is manifested by distinct clinical symptoms. This course is indicated not only by the uncertainty and expense of treatment, but also because clinically diseased animals, even when under treatment, are highly dangerous unless strictly isolated.

"In the case of specially valuable animals, such as pregnant pedigree cows, treatment may justifiably be tried, in the hope that it may carry the animal over the period of parturition, even if it does not effect a cure. The treatment may also be justified in cases in which the disease has been diagnosed in apparently healthy animals by testing with avian tuberculin or 'Johnin,' and their slaughter is not considered expedient by the owner."

See also a previous note (E. S. R., 31, p. 283).

Studies on Texas fever. First communication, C. SÁ and A. CUNHA (*Rev. Vet. e Zootech., 5 (1916), No. 6, pp. 288–303, pls. 4*).—From studies on the methods of immunization it is concluded that late injections of trypanblue do not immunize against Texas fever without serious danger to the life of the animal. An early curative injection obviates this danger without in any way affecting the immunization of the animal. Early injections are therefore recommended.

A bibliography is included.

The occurrence of pleomorphism and mutation among members of the hemorrhagic septicemia group of organisms, J. P. M'GOWAN and CHUNG YIK WANG (*Jour. Path. and Bact., 20 (1915), No. 1, pp. 21–40, pls. 2*).—The authors show "how an organism of the hemorrhagic septicemia group, by an increase of virulence through passage, has also concurrently been endowed with an increased biological activity on artificial media, whereby it grows much faster on these media and produces acid and gas fermentation in some carbohydrate media where it only produced acid or no change previously. It would seem to be essential for the success of this passage that the organism be taken directly from one animal to another without intervening growth on artificial media."

Vaccinations against hemorrhagic septicemia, J. B. HARDENBERGH and F. BOERNER, JR. (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 1, pp. 55–59*).—From experiments carried out on twelve herds of cattle and one of sheep the authors have concluded that "the use of 48-hour cultures of *Bacillus bovisepticus* subcutaneously in the dose of 0.5 cc. for sheep and 1 cc. for cattle is harmless. The immunity conferred by this vaccination has not been thoroughly demonstrated, but the sudden checking of losses in several herds may be evidence of some value. Incubation at 42.5° C. [108.5 F.] for 17 days failed to render the strains avirulent for rabbits in the dose of 0.2 cc."

A further contribution to the knowledge of the sheep disease, Septicæmia pluriformis ovium (hemorrhagic septicemia), and its control by serum vaccination, H. RAEBIGER, A. SPIEGL, and K. SCHERN (*Deut. Tierärztl. Wchnschr., 23 (1915), No. 47, pp. 406–409, figs. 2; abs. in Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 1, pp. 112, 113*).—A specific serum was obtained from three sheep which had been given repeated intravenous injections of virulent strains of *Bacillus ovisepticus*. The serum was tested on white mice and found to protect them against a 1-cc. injection of a 24-hour bouillon culture of the bacilli.

The results of the use of the serum in 13 herds are submitted in tabular form and briefly discussed. The record of a case in a lamb, together with the autopsical findings, is also reported.

The use of the serum has given promising results, both in the recovery of diseased animals and in checking the spread of the disease among healthy animals.

Sheep scab, M. Imes (*U. S. Dept. Agr., Farmers' Bul. 713 (1916), pp. 36, figs. 21*).—This publication, which supersedes Farmers' Bulletin 159 previously noted (E. S. R., 15, p. 191), furnishes information for sheep raisers and livestock sanitary officers regarding the prevention, cure, and eradication of sheep scab.

A list of nematode parasites observed in the alimentary canal of sheep in England, C. L. Boulenger (*Parasitology, 7 (1914), No. 3, pp. 240–249, pl. 1, figs. 4*).—The author has found 13 species, distributed among 10 genera, to occur in England, or nearly half of the known species.

A note on the presence of Ostertagia trifurcata in the abomasum of a sheep in England, S. Cave (*Parasitology, 7 (1914), No. 3, pp. 201–203, figs. 3*).—In addition to numerous male and female specimens of *O. circumcincta* (*Strongylus cervicornis*), a strongyle identical with *O. trifurcata* was found in the fourth stomach of a ewe at the Cambridge University farm. It is stated that previous to this discovery the occurrence of this nematode had only been recorded from the United States.

[Hog-cholera studies] (*North Dakota Sta. Rpt. 1915, pt. 1, pp. 5–8*).—In the course of a general study of hog-cholera serum the influence of the time of bleeding upon the protective value of the serum was incidentally observed. Two weeks after immunization the hog was bled from the tail, and thereafter at intervals of one week until four bleedings were obtained. The detailed results of the work are presented in tabular form, but indicate in general a slight decrease in the potency of the serum.

Hog cholera and its prevention by the use of antihog-cholera serum, B. B. Flowe (*Bul. N. C. Dept. Agr., 37 (1916), No. 3, pp. 32, figs. 19*).—This bulletin considers the subject of hog cholera in general under the titles of cause, symptoms, sanitation, means by which the disease is spread, susceptibility, mortality, and antihog-cholera serum and its use in the treatment of the disease.

Stamping out hog cholera, J. W. Connaway (*Columbia, Mo.: The Missouri Farmer [1916], pp. 80, figs. 29*).—In addition to a general discussion of the manner of dealing with hog cholera by the author, several supplementary accounts are included, namely, Profitable Pork Production, by F. G. King (pp. 45–66) and Modern Systems of Swine Management, by L. A. Weaver (pp. 67–80).

Final report of the departmental committee appointed by the Board of Agriculture and Fisheries to inquire into swine fever, with minutes of evidence and appendix (*Bd. Agr. and Fisheries [London], Final Rpt. Dept. Com. Swine Fever, pt. 4 (1915), pp. XVI+63; abs. in Jour. Compar. Path. and Ther., 28 (1915), No. 3, pp. 251–271*).—This report includes the minutes of evidence and appendixes with experimental and statistical data. The committee submits the following conclusions:

"The manure of pigs suffering from swine fever is infective. A period of 14 days may be regarded as sufficient to bring about the disinfection of infective manure through natural causes. Rats are not, as has been suggested, pathological carriers of swine fever. All the available evidence suggests that swine fever is not disseminated by external parasites.

"While persons, vehicles, and animals which have been in contact with the infected pigs or premises may carry infective material mechanically within the area of their movements, subject to the time limit indicated above, the evidence leads the committee to the conclusion that all wide dissemination of disease is due to the movement of infective pigs. A pig may become infective in three days after it has itself contracted infection and before it has actually exhibited clinical symptoms of the disease, and a pig which has contracted the

disease may continue to be infective for a variable period, the extent of which has not yet been fully ascertained, but which is often of considerable duration. There would appear to be cases in which healthy pigs which have not been visibly affected by swine fever, and which, on post-mortem examination, show no evidence of having suffered from swine fever, are infective and continue to be so for a considerable time."

In general it is concluded that "the continued prevalence of swine fever appears to be due principally to its highly contagious character and the difficulty of its recognition by the pig owner in its early stages and in its milder forms. To these causes must be added the difficulty of tracing the place of origin and the movement of pigs by which the disease has been spread. The extirpation of the disease is practicable only by such drastic measures of slaughter as would involve a prohibitive outlay, and by such severe restrictions on movement as would be fatal to the industry of pig keeping. Present circumstances, therefore, do not encourage the view that the extirpation of swine fever can be speedily accomplished or that such an objective should continue to be made the governing idea of administrative policy. This conclusion, however, does not exclude the possibility that new preventive methods may bring about a condition of affairs more favorable to the prospect of eradicating the disease, and the study of such methods is being actively pursued."

Recommendations for the control of the disease are also submitted. See also previous reports (E. S. R., 31, p. 884).

A plerocercoid found in the pig, Ratz (*Abs. in Vet. Rec., 27 (1915), No. 1394, p. 498*).—The name *Sparganum raillietti* is given to a yellowish-white filiform species which was found curled up on itself in the intermuscular connective tissue of a pig.

The occurrence and pathological importance of Strongyloides longus in swine, L. Reisinger (*Wiener Tierärztl. Monatsschr., 2 (1915), No. 5, pp. 209–239, pl. 1, fig. 1*).—This nematode (*S. longus*) occurs in swine in Austria, where, at times, it appears in extensive outbreaks, and it is also found in swine imported from Germany and England. It is the source of a disease in shoats characterized by anemia, emaciation, cutaneous eruption, diarrhea, and arrest of development. The mortality fluctuates according to the degree of infestation between 0 and 50 per cent.

Swine tuberculosis and the possibility of its practical control, O. Bang and E. Holm (*Ber. K. Vet. og Landbohöjskoles Lab. Landökonom. Forsög [Copenhagen], 88 (1915), pp. 5–63; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 7, pp. 959–961*).—From the results of investigations to determine whether, under normal conditions, mammals can be infected by fowl tubercle bacilli and, conversely, fowls by the bacilli of the mammalian form of the disease, it is concluded that the bacillus of mammalian tuberculosis is the principal cause of the disease in swine, especially in the severest forms of the disease, which are, in the majority of cases, due to infection by cattle. About 90 per cent of the cases of local glandular tuberculosis are attributable to infection with the avian bacilli. Organic tuberculosis is due mostly to infection with the mammalian bacilli.

The results of a series of tests with tuberculin showed that a positive reaction to tuberculin practically always means that the animal is infected when it is a question of bovine tuberculosis, but the reaction gives no indication of the extent of the disease. These results were obtained with tuberculin prepared from the bacilli of mammalian tuberculosis. Avian tuberculin, as far as the disease caused by the bacilli of avian tuberculosis is concerned, possesses a diagnostic value which is at least equal, and sometimes even superior, to that of bovine tuberculin.

Sanitary measures with respect to the sheltering, feeding, etc., of the pigs are outlined. These measures, in actual trial, have been shown to reduce the prevalence of the disease markedly, and are therefore recommended.

The production of a hyperimmune serum for infectious abortion in mares, E. S. Good and W. V. Smith (*Jour. Infect. Diseases, 18 (1916), No. 4, pp. 397–401*).—Continuing the work on infectious abortion in mares at the Kentucky Experiment Station (E. S. R., 27, p. 580) the authors have demonstrated that a hyperimmune serum can be prepared which has marked bacteriolytic properties in vitro.

This serum protected rabbits from the lethal dose of the organism and lengthened the time for abortion in one guinea pig 12 days. It did not, however, protect a mare from an artificial infection. The infecting dose in this case, though, was much larger than would be possible in a natural infection.

It is indicated that the serum may prove of value in a stud where the infection is known to exist.

Nature, cause, and therapy of pernicious anemia of the horse, K. R. and R. Seyderhelm (*Arch. Wiss. u. Prakt. Tierheilk., 41 (1914), No. 1–2, pp. 50–106*).—Following a brief introduction and review of the literature, the authors deal with patho-anatomical and hematological investigations; the cause of the disease, including personal investigations (E. S. R., 33, p. 681); and therapeutic tests, including the removal of Gastrophilus larvæ and the use of curative serums; give a summary of the pathogenicity of Gastrophilus larvæ; etc. A bibliography of 46 titles is included.

Swamp fever (*North Dakota Sta. Rpt. 1915, pt. 1, p. 5*).—A brief statement of work carried on in continuation of that previously noted (E. S. R., 26, p. 287). Trials of the arsenico-mercuric treatment of swamp fever gave negative results, and this treatment is looked upon by the author as worthless in the American form of the disease.

In order to test the conclusions of the Seyderhelms (E. S. R., 33, p. 681) that swamp fever is due to a toxic agent associated with the larva of the botfly, ten botfly larvæ removed from a case of swamp fever were crushed in a physiological salt solution and injected intravenously into an experimental horse. In spite of a very severe reaction this animal did not succumb nor show any marked temperature reaction or anemia during the four months it was kept under observation. Its post-mortem appearances, however, resembled those of swamp fever. Blood drawn from this horse about two weeks before its destruction, as well as that drawn immediately before, proved to be virulent in experimental horses and, in all particulars, the clinical as well as the patho-anatomical aspects of these cases resembled those seen in the artificially induced swamp-fever cases. Blood drawn from the experimental horses infected by blood from the first-mentioned horse infected another horse in a similar manner. As an indication of the tenacity of the virus it is stated that the blood of an experimental animal infected in 1908 and to all appearances recovered produced the usual febrile reactions in a healthy experimental horse in 1915.

Notes on a little-known rabbit ear mite (Psoroptes cuniculi), A. B. Duckett (*Jour. Amer. Vet. Med. Assoc., 48 (1916), No. 6, pp. 726–730, figs. 3*).—*P. cuniculi*, the cause of the disease commonly known as rabbit ear mange, is recorded from the United States for the first time. Its presence in the ears of two rabbits appears to have been responsible for their death. *Listrophorus gibbus*, found in the hair of a white rabbit kept in a pen adjacent to one of the rabbits mentioned above, is also recorded from America for the first time.

On the transmission from mother to offspring of immunity against fowl cholera, P. B. Hadley (*Centbl. Bakt.* [etc.], *1. Abt., Orig., 76 (1915), No. 2–3,*

pp. 196–206).—This material has been previously noted from another source (E. S. R., 31, p. 485).

On the anatomy of a fowl tapeworm, Amœbotænia sphenoides, F. J. Meggitt (*Parasitology, 7* (*1914*), *No. 3, pp. 262–277, pls. 2*).—In addition to the anatomy the author briefly considers the life history of this parasite.

RURAL ENGINEERING.

A new irrigation weir, V. M. Cone (*U. S. Dept. Agr., Jour. Agr. Research, 5* (*1916*), *No. 24, pp. 1127–1143, figs. 16*).—Experiments conducted under a coöperative agreement between the Office of Experiment Stations and the Colorado Experiment Station are reported. The purpose was to develop a weir "that would be self-cleaning, require a minimum amount of labor and material for construction, measure discharges with an accuracy commensurate with field conditions and irrigation demands, and be easily operated by the ordinary man."

Altogether 277 experiments were made with a new type of weir using both rectangular and 90°-triangular notches. Thirty-four different arrangements of weir box were used for the rectangular notches, the length of weir crest varying from 1 to 4 ft., and the width of weir box at both the crest and 20 ft. from 1.5 to 6 times the length of crest. Floor lengths of 32.67 and 20 ft. were used. From the results a weir was developed, the general formula for the discharge of which is $Q=(3.83-0.7L)\ Lh\ (1.52+0.01L)$ in which Q=the discharge, L=the length of crest, and h=the head on the weir. The computed discharges for the new weirs are given in tabular form.

The tests brought out the following advantages: "The new irrigation weir is self-cleaning. . . . No lowering of the canal grade or building up of the banks is required for the construction of the weir box. The weir box has only one-fourth the depth and a less width than is required for a full-contraction weir. Less excavation and less materials are needed in the construction, and the cost of the weir is therefore greatly decreased. It may be installed by the farmer without expert assistance and with the tools ordinarily at hand. Its operation does not require special training. Its accuracy is consistent with practical demands and will remain constant. It can not be easily tampered with or accidentally injured so as to alter its discharge. There are no working parts which require attention for proper operation. There is practically no upkeep expense if the weir is well constructed of durable materials. When the discharge tables are used, no computations are required."

Specifications for the construction and use of the new weir are as follows: "The weir notch is rectangular in form, with sharp crest and sides. The floor of the weir box must be level with the crest. . . . The grade of the canal downstream from the weir must be low enough to give free fall and complete aeration to the nappe. The floor of the weir box must be level throughout, and there must be no sudden or decided differences in elevation between the floor and the grade of the channel of approach. The weir box must be placed in the center of the ditch, so the axial line of the box corresponds with the axial line of the canal, in order that the water may enter the weir box in straight lines. The width of the weir box must be twice the length of the weir crest at the plane of the weir, and two and a half times the length of the weir crest at a distance of 20 ft. upstream from the plane of the weir. . . .

"It is necessary that a still box be placed outside the weir box and connected through the side of the weir box with one or more 1-in. pipes located 6 ft. from the plane of the weir. The pipe should be placed near the floor

of the weir box to insure its being submerged for low heads, and care must be used to place the pipe normal to the side of the weir box, and not normal to the axis of the box. . . . The still box should have inside dimensions of at least 1 ft. by 1.5 or 2 ft., with such depth as is necessary. . . .

"The new irrigation weir may be constructed of lumber, but the design is such that it may be easily constructed of concrete. There would be no difficult form work required for the concrete, and it would make an inexpensive, durable, and satisfactory measuring device, especially if the angle-iron sides and crest of notch were used in connection with the concrete box."

Fourth biennial report of the Department of Engineering of the State of California, 1912–1914 (*Bien. Rpt. Dept. Engin. Cal., 4 (1912–1914), pp. 285, pls. 47*).—This report reviews the history of engineering work in California and deals with the practice in the State on the special subjects of architecture, hydroeconomics, and state roads and highways. Data on water and water-power resources in the State, obtained in cooperation with the U. S. Geological Survey, and data from irrigation investigations, conducted in cooperation with the Office of Experiment Stations of this Department and with the California Experiment Station, are also reported. These include a progress report of irrigation investigations by F. Adams for 1912 to 1914 (E. S. R., 29, p. 588), a report of an investigation of wells in the Imperial Valley by C. E. Tait, and a report on investigation of wells in the Imperial Valley by W. A. Hutchins.

Report on irrigation for the year 1914 (*Dept. Int. Canada Ann. Rpt. 1914, pt. 7, pp. 222, pls. 25, figs. 33*).—Reports are included on the Cypress Hills, western Maple Creek, and Calgary irrigation districts; on the south Saskatchewan water supply and Oldman River diversion projects; on the Cypress Hills reservoir surveys; on cost data on reservoir water; on work in connection with the international waterways treaty; on duty of water investigations; and on principles governing the design and operation of irrigation systems.

Duty of water experiments and farm demonstration work (*Dept. Int. Canada, Irrig. Ser. Bul. 4 (1915), pp. 62, pls. 9, figs. 15*).—This report presents detailed information dealing particularly with practical field irrigation work and general returns on irrigation crop production. Sectional reports are included on the duty of water at Strathmore and Ronalane, Alberta, alkaline soil conditions, and a general crop report by G. D. Walters; the duty of water at Coaldale, Alberta, by W. H. Snelson, and crop report for the Eastern Maple Creek District, by M. H. French, the Western Maple Creek District, by H. R. Carscallen, and the Calgary District, by R. H. Goodchild.

Report on the climatic and soil conditions in the Canadian Pacific Railway Company's irrigation project, western section (near Calgary, Alberta) (*Dept. Int. Canada, Irrig. Ser. Bul. 3 (1915), pp. 24*).—This report includes sections on climatic conditions and on the temperature of water in irrigation canals, by G. N. Houston, and on soils and analysis of water from irrigation canals, by F. T. Shutt.

In the first section it is concluded that "the climatic conditions in the western section are similar to those in several other places where irrigation has been successfully practiced for many years and, therefore, there is no reason, so far as climate is concerned, why it should not be successful there. . . . It is evident that irrigation is very desirable on the western section."

With reference to temperature of water it is concluded that "the water applied to crops on the western section is of a higher temperature than that used in many places where irrigation is carried on successfully, [and] is generally of a higher temperature than the rain water. The application of irrigation water to the crops in the western section will not result in seriously retarding their growth."

Geology and water resources of Sulphur Spring Valley, Arizona, O. E. MEINZER and F. C. KELTON (*Arizona Sta. Bul. 72 (1913), pp. 231, pls. 15, figs. 32*).—This is a reprint of U. S. Geoolgical Survey Water-Supply Paper 320 (E. S. R., 30, pp. 18, 85). The publication previously noted as Bulletin 72 of the Arizona Station (E. S. R., 32, p. 513) constitutes one chapter of the present publication.

The Ohio water problem, C. E. SHERMAN (*Ohio State Univ. Bul. 20 (1915), No. 10, pp. 135, pls. 6, figs. 19*).—"This bulletin is directly the result of two lectures, one given in the engineering and one in the university lecture course at Ohio State University in January, 1913, and January, 1914, respectively. The subject of the first was river and harbor improvements, and of the second the Ohio water problem." The following chapters are included: Preliminary considerations, floods, flood-protection plans, economics of water transportation, broader aspects of water transportation, water power, miscellaneous uses, Sandusky-Scioto conservancy, and a state-wide survey. Maps and tabular and graphic data are included.

Flood protection in Indiana, W. K. HATT (*Proc. Ind. Acad. Sci., 1914, pp. 149–156*).—This is a brief review of the findings of the Indiana Flood Commission, appointed to study flood causes and flood-prevention methods in Indiana.

Report from the water laboratory, H. E. BARNARD (*Ind. Bd. Health, Ann. Rpt. Chem. Div. Lab. Hyg., 9 (1914), pp. 155–163, figs. 5*).—Of the 1,645 samples of water analyzed during 1914, 702 were collected from so-called shallow wells, 656 from deep wells, 96 from streams, 84 from springs, 48 from cisterns, 27 from lakes and ponds, and 32 from miscellaneous sources; 1,342 of these samples were from private supplies, mainly private wells, while 303 samples were from public supplies.

Of the total number examined, 1,021 waters were reported as good, 414 as bad, and 210 as doubtful. Of the private water supplies examined, 509 were from deep wells, 684 from shallow wells, 48 from cisterns, and 69 from springs; 767 of all the private samples examined were potable, 381 were condemned as bad, and 194 were classed as doubtful. Of the 509 deep wells analyzed, 426 were furnishing good water, 36 were reported as bad, and 47 as doubtful. Of the 684 shallow wells, but 246 furnished potable water, while 308 were unqualifiedly bad, and 130 were doubtful. Of the 48 cistern waters, 22 were good, 21 bad, and 5 doubtful. Of the 69 spring waters, 49 were good, 10 bad, and 10 doubtful. These results are taken to indicate that the shallow well as a source of private water supply is greatly to be feared.

Limits of potability of the waters of the Province of Buenos Aires, F. A. MAZZA (*An. Soc. Quim. Argentina, 3 (1915), No. 10, pp. 167–183*).—Data on the maximum tolerable chemical limits of potability of the waters of different parts of the Province of Buenos Aires, as determined by local surroundings and conditions, as well as by analyses, are reported.

Sewage treatment and disposal, B. J. ASHLEY (*Farm Implements, 30 (1916), No. 1, pp. 70, 72*).—In a brief statement of the fundamental principles of the design of small sewage treatment and disposal systems, special attention is drawn to the importance of the colloidal media for aerobic organisms in nitrification systems and to the existence and action of colloids in sewage as important factors affecting design.

Activated sludge method in England (*Municipal Jour., 40 (1916), No. 6, pp. 199, 200*).—Recent experiments at Salford, England, on duration of aeration, winter operation, and possibility of continuous flow led to the conclusion "that it would be perfectly practicable to reduce the aeration to one hour." It is also thought that "where only domestic sewage is treated the time of aeration

might be reduced still lower. . . . As to the effect of cold weather, the experiments on two-hour and one-and-a-half-hour aeration covered the coldest part of the year, and during this time the lowest recorded temperature of crude sewage treated was 51° F. . . . The best results obtained were when working with from 20 to 25 per cent of sludge, the excess being usually pumped to the drying area from the first and second settling tanks twice a week. From the comparatively small effect of the sterilizing trade wastes it is concluded that 'the influence of sterilizing substances which play such havoc with bacteria beds generally can readily be overcome.'"

A new method of land clearing, H. D. SCUDDER (*Oreg. Countryman, 8 (1916), No. 4, pp. 259–266, figs. 7*).—Experiments with a newly developed stump burning method are reported.

The outfit required consists of two heavy cast-iron pieces, namely, the furnace and the hood. The furnace is so placed against the unbanked portion of the stump as to direct the fire toward its center the long way through and is then banked. A stovepipe is placed in the top of the furnace and a draft pipe from 10 to 12 ft. long into the front. A blast of flame is thereby driven against the heart of the stump, and, after burning through, the furnace is removed and the hood, fitted with the chimney, put in its place and charpitting continued until the stump is destroyed.

The tests so far show that the time the stump burner outfit is required averages about one day for each foot diameter of stump. The tests indicate that the cost will vary from 50 to 80 cts. per stump if all the labor is hired.

Proceedings of the eleventh annual convention of the American Road Builders' Association, 1914 (*Proc. Amer. Road Builders' Assoc., 11 (1914), pp. 391, pl. 1, figs. 10*).—These proceedings include the following special papers:

Road and Pavement Dimensions—Widths, Depths, and Crown, by L. White; Road Foundations—Concrete, Telford, Gravel, etc., by J. A. Johnston; Organization of a State Highway Department, by J. N. Carlisle; Traffic—Present Tendencies, Probable Development, and Regulation, by A. W. Dean; Machinery for Construction and Maintenance—State, Municipal, Contractors, Traction Haulage of Stone, Care of Machinery—Instructions to Engineer and Operator, by T. R. Agg; Brick Roads and Streets, by J. Laylin; Surfaces or Floors for Bridges, by C. Older; Bituminous Construction and Maintenance—Recent Practice, by W. D. Uhler; Concrete Roads, by H. J. Kuelling; Recent Practice in Construction in Wood and Granite Block, by W. A. Howell; Present Practice in Earth and Gravel Road Construction and Maintenance, by I. O. Baker; Street Paving in Small Cities, by T. H. MacDonald; Convict Labor in Road Construction, by T. J. Ehrhart; and Dust Prevention and Street Cleaning, by W. H. Connell.

Relation of mineral composition and rock structure to the physical properties of road materials, E. C. E. LORD (*U. S. Dept. Agr. Bul. 348 (1916), pp. 26, pls. 8, figs. 3*).—In this bulletin a microscopic method of rock analysis by means of a cross-line grating is reviewed and the average mineral composition and physical properties of all rocks analyzed and tested in the Office of Public Roads and Rural Engineering up to January 1, 1914, are given in tabular form. "This material has been classified according to composition and structure and the rock-forming constituents have been discussed under the groups of primary and secondary minerals with a view to explaining their essential physical characteristics. The physical properties of rocks for road making and the method of testing this material have also been given and the results obtained used to show, first, in a general way, the relation between these properties and the mineral composition and structure of rocks; and, secondly, to point out more specifically the effects of secondary compounds upon them."

The results obtained in these investigations are taken to indicate the following:

"Igneous and nonfoliated metamorphic rocks, owing to a preponderance of hard silicate minerals combined with greater uniformity in structure, are more durable than other road-making materials, finer-grained varieties offering greater resistance to abrasion than coarse-grained types. The resistance to wear of igneous and metamorphic rocks, containing an abundance of quartz, hornblende, augite, epidote, and garnet, is greater than that of similar rocks rich in mica, chlorite, serpentine, and calcite.

"Foliated metamorphic rocks, owing to the parallel arrangement of their mineral constituents, are, as a rule, deficient in toughness, and therefore not well adapted to road construction. Sedimentary rocks are usually deficient in wearing properties, except in the case of highly indurated sandstones, containing a moderate amount of siliceous clay, cement, and limestones or dolomites rich in quartz and having very little clay.

"Rocks for road making break down under impact into fragments, the shape and physical character of which are conditioned by mineral composition and structure.

"The effect of weathering is generally to lower the resistance to wear of road materials, owing to the development of soft, in part colloidal, products of alteration. Where the secondary minerals are harder and more crystalline the wearing properties of the rocks are proportionately increased.

"The cementing value of road materials is conditioned chiefly by the colloidal products of rock decay and increases in a general way proportionately with these products, reaching a maximum in rocks free from quartz. The slaking property of rock powders is dependent in the case of siliceous igneous and metamorphic rocks chiefly on the physical character of the primary mineral components, whereas in basic igneous rocks and sandstones it is caused to a large degree by colloidal products of rock decomposition."

See also a previous note by the author (E. S. R., 25, p. 890).

A new penetration needle for use in testing bituminous materials, C. S. Reeve and F. P. Pritchard (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 24, pp. 1121–1126, pl. 1*).—Experiments conducted in the Office of Public Roads and Rural Engineering are reported, as a result of which the following conclusions are offered:

"The No. 2 sewing needle which has heretofore been used for the penetration test can not be taken indiscriminately, but must be carefully selected and standardized. There is no recognized established standard with which new needles can be compared, and it is not feasible to accurately describe the dimensions of a parabola needle. The so-called standard needles furnished with penetration machines may vary among themselves.

"The writers have designed a needle which gives results in close accord with existing standards and has, moreover, the advantage of being accurately described and easily reproduced. The needle is made by placing a 2-in. length of 0.041-in. annealed-steel drill rod in the chuck of a high-speed lathe and by means of a fine sharp file turning the end to a sharp point having a ¼-in. taper. When it has been made as smooth and sharp as possible by this means the needle is tempered, then ground to a sharp point with a good stone, after which it is smoothed and polished with emery dust, crocus cloth, and rouge, and finally held carefully on a buffing wheel. The finished needle should be sufficiently smooth and sharp to enter and pass through a piece of ordinary writing paper without sticking or friction. This new needle must have as sharp a point and smooth a surface as any sewing needle. The important thing is to have the taper straight,

beginning $\frac{1}{4}$ in. from the end, and the needle above the taper exactly 0.04 in. in diameter."

The use of hydrated lime in Oregon State concrete roads, R. S. Edwards (*Nat. Lime Manfrs. Assoc. Bul. 18 (1915), pp. 15, figs. 2*).—A review of concrete road practice in Oregon in 1914, especially in Jackson County, is given, which, it is thought, has proved that the addition of hydrated lime in quantities ranging from 5 to 10 per cent of the weight of the cement used in concrete paving work shows the following advantages:

"(1) Decrease in labor cost in placing and surfacing the concrete. . . . (2) Twenty per cent reduction of the transverse cracking of a 6-in. concrete road slab under Jackson County climatic conditions, resulting in a saving of $\frac{1}{2}$ ct. per square yard, where asphalted felt joints were used, or 2 cts. per square yard, where armored joints were used. There is also a future saving in maintenance cost. . . . (3) The concrete surface of a pavement in which hydrated lime was used has actually shown a more uniform and dense finish and a more uniform wear."

In conclusion, the following suggestions are made: "In one-course concrete pavements, which are not to be treated or surfaced with bitumen or oil, 8 per cent of hydrated lime would seem sufficient to secure the stated results. In concrete pavements which are to be treated with a bitumen wearing surface, from 10 to 12 per cent of hydrated lime should prove sufficient and beneficial, and in such cases an increase in the aggregate is justified. In two-course concrete pavement, the wearing surface of which is to take the traffic, it would seem advisable to use 10 per cent hydrated lime in the base course with 5 per cent in the top course. In rich surface mixtures, such as one cement, one sand, and two crushed-rock screenings, the amount of cement per yard of concrete is high, and a greater percentage of hydrated lime than 5 per cent is not necessary and should not be used."

See also a previous report by the author (E. S. R., 31, p. 387).

Loading of bridge floors (*Cement Era, 14 (1916), No. 2, p. 60*).—Tests by the Ohio Highway Department on the distribution of concentrated loads on highway-bridge floors are reported, the object of which was "to obtain a sufficient knowledge of the distribution of loads through and by concrete floor slabs to enable the designer to rationally proportion the joists of a slab floor, and also the slab itself, to carry concentrated loads. . . .

"The following conclusions regarding the distribution of concentrated loads on a reinforced concrete slab, to the floor joists, seem to be warranted by these tests: (1) The percentage of reinforcement has little or no effect upon the load distribution to the joists, so long as safe loads on the slab are not exceeded. (2) The amount of load distributed by the slab to other joists than the one immediately under the load increases the thickness of the slab. (3) The outside joists should be designed for the same total live load as the intermediate joists. (4) The axle load of a truck may be considered as distributed uniformly over 12 ft. in width of roadway. (5) If the slab has ample grip on the upper flange of the I-beam and is continuous over the floor beams and the joists are riveted to the web of the floor beams, the live load stress in the joist may be but one-half as great as for a similar load on the bare I-beam supported at its ends. (6) Under these favorable conditions the axle load in a panel of not more than 20 ft. may be assumed as uniformly distributed over two-thirds of the length of the joists considered as simple I-beams supported at the ends. Without these conditions, the load may be assumed as uniformly distributed over a length of at least 5 ft.

"In a slab of a certain span and indefinite width, there is some width symmetrical with the load beyond which a single concentrated load will have no

effect. The stresses in this slab will be a maximum under the load and will decrease in each direction from it. The 'effective width' of a slab is that width used in designing over which a single concentrated load may be considered as uniformly distributed on a line down the middle of the slab parallel to the supports.

"The tests of slabs seem to warrant the following conclusions: (1) The 'effective width' is affected very little by the percentage of transverse reinforcement (parallel to supports). (2) The 'effective width' decreases somewhat as the load increases. (3) The 'effective width' in percentage of the span decreases as the span increases. (4) The following formula will give a safe value of 'effective width' where the total width of slab is greater than $1\frac{1}{3}\ S+4$ ft.: $e=0.6\ S+1.7$ ft., where e=effective width in feet and S=the span in feet."

Charts for estimating the strength of bolts, W. F. FISHER (*Power, 43 (1916), No. 2, pp. 42, 43, figs. 2*).—Two charts are presented, showing the strength of threaded bolts from 0.25 to 2.5 in. in diameter. These were prepared from the formula $L=A\times f$, in which L=the load on the bolt in pounds in tension, A=the area in square inches of the bolt at the root of the thread, and f=the unit fiber stress on the bolt material at the root of the thread in pounds per square inch.

Explosion period in gas engine, R. S. KING (*Power, 43 (1916), No. 2, pp. 48, 49, fig. 1*).—The results of experiments on a 6-horsepower, 4-stroke-cycle, hit-and-miss governed gas engine with make-and-break ignition are reported, which indicate that the rapidity of explosion is greatest with the best mixtures and increases with the compression.

Gasoline farm tractors, P. S. ROSE (*Engin. Mag., 49 (1915), No. 5, pp. 750–752, figs. 6*).—This is a review of the development during the past few years of internal combustion machines for heavy haulage about the farm.

Demonstrations of motor plows and tractors (*Jour. Bd. Agr. [London], 22 (1915), No. 8, pp. 760–766*).—A brief description of different motor plowing outfits and a review of results obtained in demonstrations at different localities in England are given.

Demonstration of mechanical cultivation and of agricultural motors, Parma, 1913, M. CASTELLI and G. D. MAYER (*Concorsi di Aratura Meccanica e di Motori Agricoli. Milan: Cattedra Ambulante d'Agricoltura di Parma, 1913, pp. 234, figs. 57*).—The first part of this report describes and illustrates a number of mechanical cultivating outfits of both American and European make, including internal-combustion motor plows and cultivators, internal-combustion and steam tractors, and cable plowing outfits, and presents and discusses the results of tests of each on a soil of widely varying texture. The second part describes and illustrates a number of stationary and portable internal combustion farm engines, mainly of European make, and reports and discusses tests of each. In both sets of tests internal-combustion motors were included, operating on high- and low-grade fuels.

The mechanical cultivation of the soil, P. MATHIS (*Agr. Colon. [Italy], 9 (1915), Nos. 3, pp. 129–147; 4–5, pp. 227–249, figs. 5; 6, pp. 345–358, figs. 8; 7, pp. 403–419, figs. 5*).—This article points out the importance of mechanical cultivation in the agriculture of colonial Italy, describes steam, electrical, and internal-combustion power in their application to mechanical cultivation, and describes and discusses a large number of mechanical plowing outfits, including tractors, motor plows, and cable outfits of both American and foreign make.

The relation of mechanical cultivation to intensive agriculture, A. DAUTRY (In *Primera Semana Social Agrícola. Santiago de Chile: Universidad Católica*

de Santiago, 1914, pp. 15–52, figs. 12).—This article points out the importance of good physical and chemical condition of soil to crop production and describes and illustrates a number of mechanical tillage outfits which are adapted to intensive agriculture. A bibliography is appended.

A new spray nozzle, C. W. WOODWORTH (*U. S. Dept. Agr., Jour. Agr. Research, 5 (1916), No. 25, pp. 1177–1182, pls. 2, fig. 1.*)—A new principle in nozzle construction is described as developed at the California Experiment Station whereby a flat spray can be produced with a uniform distribution of the water comparable to that of the hollow cone of spray from a cyclone nozzle. "The principle finally discovered was that when two streams meet across half their section the resulting sheet of spray will be of practically uniform thickness throughout, occupying a plane 45° from the plane of the streams and finally breaking up into drops of great fineness and uniformity. . . . A flat spray is more easily directed and produces a more uniform distribution than the cone of spray from a cyclone nozzle. Uniformly fine drops of spray aid in securing uniformity of distribution. The new nozzle allows some variation in size of spray. It also may be made into a long or short distance nozzle. It can be easily constructed by modifying existing nozzles and may be adjusted if it becomes worn."

Wire fencing, W. SOMERVILLE (*Jour. Bd. Agr. [London], 22 (1915), No. 8, pp. 721–737, fig. 1*).—A brief description of the methods and tools used in the construction of wire fences inclosing stock pastures in England and Scotland is given, together with statements of cost.

Rural structures of wicker, CAMILLE ARNOULD (*Vie Agr. et Rurale, 5 (1915), No. 16, pp. 292–294, figs. 6*).—The uses of wicker in the construction of fences, shelters, buildings for stock, cottages, etc., and for river-bank protection against erosion are described.

RURAL ECONOMICS.

Selected readings in rural economics, compiled by T. N. CARVER (*Boston and London: Ginn & Co., 1916, pp. VIII+974, figs. 11*).—This book contains a large number of selected articles, chosen with a view to making available to the student of agricultural economics a mass of material which has been published in widely different places and treating of the general principles of rural economics, the agricultural history of Europe and America, land tenure, agricultural labor, the farmer's business, agrarian movements in the United States, rural organization and marketing, and agricultural policy.

The articles included are as follows: The Influence of the Crops upon Business in America, by A. P. Andrew; The Influence of Farm Machinery on Production and Labor, by H. W. Quaintance; Crop Yields and Prices, and Our Future Food Supply, Some Suggestions for City Persons who Desire to Farm, and Some Important Factors for Success in General Farming and in Dairy Farming, by G. F. Warren; Iowa and Bavaria Crop Yields per Acre and per Man, by E. A. Goldenweiser; Agriculture in the Middle Ages, by W. F. Allen; Inclosures in England in the Sixteenth Century, by E. F. Gay; Yeoman Farming in Oxfordshire from the Sixteenth Century to the Nineteenth, by H. L. Gray; The Decline of Landowning Farmers in England, by H. C. Taylor; The Epochs of German Agrarian History and Agrarian Policy, by C. J. Fuchs; The Disposition of Our Public Lands, by A. B. Hart; Southern Agriculture, 1790–1860, by M. B. Hammond; The Agricultural Development of the West During the Civil War, by E. D. Fite; Agricultural Development in the United States, 1900–1910, by J. L. Coulter; The Movement of Wheat Growing—A Study of a Leading State, Relation of Jobbers and Commission Men to the Handling

of Produce, and Studies in Egg Marketing, by C. W. Thompson; The Law and Custom of Primogeniture, by G. C. Brodrick; The Land System of France, by T. E. C. Leslie; The Land System of Belgium and Holland, by E. de Laveleye; The State Small Holdings in Denmark, The English Agricultural Laborer, by H. R. Haggard; Tenancy in the United States, by G. K. Holmes; Tenancy in the North Atlantic States, Tenancy in the North Central States, Tenancy in the Southern States, and Tenancy in the Western States, by B. H. Hibbard; On the Recollections of a Hired Man, by M. A. Barber; The Farmer's Income, by W. J. Spillman; Profits that Farmers Receive, by E. H. Thomson; The Rise of the Granger Movement, and The Outcome of the Granger Movement, by C. W. Pierson; The Populist Movement, by F. L. McVey; An Analysis of Agricultural Discontent in the United States, by C. F. Emerick; Agricultural Syndicates in France, by H. W. Wolff; The Technique of Mediæval and Modern Produce Markets, by A. P. Usher; Studies in the Marketing of Farm Products in France and England, by E. K. Carver and G. L. Wilson; The Irish Land Purchase Act of 1903, by C. F. Bastable; State Bounties and the Beet-sugar Industry, by P. T. Cherington; Beet Sugar, by F. W. Taussig; and Agricultural Credit in the United States, by J. E. Pope.

Land tenure reform and democracy, G. E. Putnam (*Polit. Sci. Quart., 31 (1916), No. 1, pp. 53–65*).—Among the solutions of our land tenure problem suggested by the author are the acquiring of the land by the Government to be leased in such a way as to render ultimate ownership possible, the imposing of an additional tax on land not operated by owners and a progressive tax upon all holdings above a certain minimum value, and the establishment of better systems of land credit. He claims that the present system places a premium upon tenancy because of the short term of mortgages and the interest charges being high compared with the natural returns of the land.

The State as farmer, G. Radford (*London: Smith, Elder and Co., 1915, pp. 149*).—The author outlines his conception of the relation of the State to farming. He believes it is the function of the State through proper instruction and regulation to bring about such use of land as to prevent waste, as for example the more extensive production of poultry and pork to consume the waste products of the farm, the keeping of a type of cow giving a high yield of butter, the destruction of weeds, better marketing facilities, and arrangements to prevent gluts.

Relation of the Government to the marketing problem, B. T. Galloway (*Cornell Countryman, 13 (1916), No. 5, pp. 370–372, 398, 400, 402*).—Among the ways suggested that the Government may function in solving the marketing problem are in lending its aid in determining and fixing standards, in developing the principles that should govern in the storing and warehousing of farm products, in extending knowledge concerning the marketing of farm products, and in gathering and disseminating information regarding the supply and demand for perishable products that would be helpful to the producer and consumer alike. The author believes that there should be a combined climate, crop, and market information service somewhat similar to the present system of reporting crop and weather conditions.

Community organization for live stock improvement, G. C. Humphrey (*Hoard's Dairyman, 51 (1916), No. 4, pp. 137, 152, 153, fig. 1*).—The author has given a brief history of the community live-stock organization movement in Wisconsin and outlines some of the essentials to success. He points out the advantages of community organization as follows: In dairy cattle associations it encourages cow testing work; it provides a most economical system of advertising and offers special inducement for buyers seeking carload lots of ani-

mals; it offers better opportunities for men to cooperate in buying and importing foundation stock; and it gives the farmer new ideas toward which to work and makes farm work more fascinating and enjoyable.

Rural clubs for women, Emma R. Davisson (*Nebr. Col. Agr. Ext. Bul. 36* (*1915*), *pp. 3–14, figs. 3*).—This bulletin gives a number of typical examples of women's rural clubs, directions for organizing and conducting clubs, a model constitution, and methods of procedure. It also contains a brief outline for a course of study for home economics clubs and topics for club discussions.

Farm mortgage credit in New Hampshire, G. C. Smith (*N. H. Col., Arts and Sci. Research Bul. 2* (*1916*), *pp. 16, figs. 3*).—This study is based upon answers to a questionnaire sent to banks and farmers in New Hampshire.

The savings banks and building and loan associations all reported that the rate at which loans are made on farm mortgages is 5 per cent. Of the farmers reporting on loans from banks 88 per cent reported the rate as 5 per cent and the remaining 12 per cent as 6 per cent; of the farmers reporting on loans from other sources 76 per cent reported the rate as 5 per cent, and the remainder as 6 per cent. With reference to the payment of mortgages, 75 per cent of the farmers reported them as payable on demand, and 73 per cent stated that this system was satisfactory. The reports indicated that the average loans approximated 58 per cent of the total value of the property mortgaged. The banks reported that 84 per cent of the mortgage loans was taken care of by the banks, while the farmers reported that 61 per cent was so obtained.

The author believes that well-planned rural-credit institutions are imperative in some of our States and would undoubtedly serve a useful purpose in New Hampshire, particularly in those sections of the State where the farmers have experienced difficulty in securing loans from the savings banks. The survey, however, does not indicate, in his opinion, that existing conditions in New Hampshire are so distressing as to require extensive loaning facilities of a kind different from those already in existence.

An agricultural survey of Brooke County, O. M. Johnson and A. J. Dadisman (*West Virginia Sta. Bul. 153* (*1915*), *pp. 32, figs. 18*).—The authors summarize the results of this survey, compiled from the records of 201 farms with an average labor income of $125, as follows:

"In order to secure an income that will permit a satisfactory standard of living, the farm business must be of considerable size. Where the situation permits very intensive farming, such as trucking, fruit growing, etc., a large business may be conducted on a few acres; but where the conditions are such as to require general farming, as most kinds of live-stock farming, the acreage must be larger. A farmer with a very small acreage who can not engage in intensive farming because of a lack of markets for the products would find it to his advantage to rent additional land, or, in some cases, to sell his small farm and invest his capital in the necessary work stock and implements to farm a larger area and become a tenant on a farm of sufficient size to give an opportunity to earn a good income.

"There is a close relation between the amount of capital invested and the family income, but on many farms where the capital is large, organization is poor, and there is no income for labor. . . . A combination of enterprise including dairy, truck, fruit, or general crop farming organized to suit individual needs seems to be most desirable. . . .

"There is no striking difference in production in the groups of farms of different sizes nor in the small and large herds. The form in which the product is marketed has a considerable influence on the value of the product per cow—market milk paying best. . . .

"The labor income on farms operated by tenants is larger than on farms operated by owners, but the tenant's capital is small and his income available for use of the family is smaller than that of the owner operating his own farm. Share renting usually gives the owner a larger return on his investment than cash rental.

"A farm which gives a labor income of $500 in addition to furnishing a home and a large part of the living is a good business. While the number making this labor income is not large, about 20 per cent, indications are that opportunities are open for farmers on well-organized farms in this county.

"Since truck and dairy farming are the most profitable types and a rather large area is available which is adapted to these industries, they can be materially increased. Markets for the products will be the first limitation. So far as can be seen now there is little danger of oversupplying the markets that can be reached. The farms some distance from the railroads or trolley lines can produce butter at a profit if good producing cows are kept, and in addition many of these farmers would find it profitable to develop gradually pure-bred herds from which they might sell surplus stock."

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt. 2 (1916), No. 3, pp. 21–28, fig. 1*).—Included in this report are estimates concerning the amount of wheat, oats, corn, and barley on farms March 1, the amounts shipped out of counties where grown, and the amount of the crop of merchantable quality. Data are also given showing the wheat held at country mills and elevators, wheat exports, prices, and freight rates, the amount of the merchantable corn crop, the farm movement and prices of wheat by months, and a diagram showing the receipts of wheat weekly at primary markets for 1914–15 and 1915–16, as compared with the five-year average for 1910–1915.

The wages of male farm labor with and without board are given per month, per day at harvest season, and per day at other than harvest season. The estimated farm value of important products on February 15 and March 1 is given, together with the range of prices of agricultural products at important markets. Data are given showing the percentages for the different grades of the total cars of winter and spring wheat inspected at Chicago for a series of years. The conditions of crops in Florida and California and of the early southern truck crops on February 1 and March 1 are given.

The Louisiana cane sugar crop for 1915 is estimated at 136,500 short tons as compared with 242,700 short tons in 1914. The Texas onion crop of 1916 is estimated to cover 10,657 acres as compared with 9,343 acres in 1915. Other miscellaneous data are included.

Agricultural statistics of Argentina, 1913–14 (*Estad. Agr. [Argentina], 1913–14, pp. 186*).—This report continues information previously noted (E. S. R., 31, p. 595), adding data for later years.

Agriculture of Morocco, J. Chailley (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 2, pp. 48–60*).—These pages give the extent of the production of the principal agricultural crops and the number of live stock, and describe the general agricultural conditions.

Estimates of area and yield of principal crops in India, 1914–15 (*Dept. Statis. India, Est. Area and Yield Princ. Crops India, 1914–15, pp. 25, pls. 3*).—This report contains statistical data concerning the area and production of the principal crops for the crop seasons 1905–6 to 1914–15 by Provinces. Methods of determining the estimates and collecting the data are outlined.

AGRICULTURAL EDUCATION.

The forthcoming situation in agricultural work—II, L. H. Bailey (*Science, n. ser., 43 (1916), No. 1099, pp. 77–87*).—This address of the retiring vice-president of Section M of the American Association for the Advancement of Science is in continuation of an address at the previous annual meeting (E. S. R., 32, p. 102), and has been noted elsewhere (E. S. R., 34, p. 396).

On the training of teachers of nature-study, R. E. Wager (*Nature-Study Rev., 12 (1916), No. 2, pp. 47–55*).—The author discusses the training of teachers of nature study as it concerns the understanding of the nature of the physical and mental development of the child and the elements in training essential to wise and forceful instruction.

High school extension in agriculture, C. H. Lane (*Better Schools, 2 (1916), No. 2, pp. 44–48*).—The author calls attention to the need of lengthening the school year and of securing a larger daily attendance of pupils, and discusses the problem of making the school funds and equipment of rural high schools contribute to the education of all the people of the school district by means of extension work in agriculture. Extension work is defined and suggestions are given concerning different forms of such work and the training of high school agricultural extension workers.

[Progress in agricultural education in Manitoba] (*Rpt. Dept. Agr. and Immigr. [Manitoba], 1914, pp. 23–29, 90–93, pl. 1, figs. 4*).—This report contains information for 1914 similar to that given for 1913 (E. S. R., 33, p. 396).

Annual report of the director of education [of the Philippines] (*Ann. Rpt. Dir. Ed. P. I., 15 (1914), pp. 166, pls. 12*).—This report includes an account of progress in agricultural and home economics instruction in the Philippine Islands from January 1 to December 31, 1914.

Teachers' farm school (*Jour. Dept. Agr. Victoria, 13 (1915), No. 11, pp. 641–660, figs. 13*).—This is a report on the first teachers' farm school in Victoria, Australia, held September 20–24, 1915, at the State Research Farm, Werribee, by the state departments of agriculture and education. Lectures and practical field demonstrations were held daily from 9 a. m. to 10 p. m., attended by about 70 teachers of agriculture.

In the opening address Dr. S. S. Cameron, director of agriculture, stated that it was well known that the agricultural education work carried out in Victoria had been somewhat disjointed, and that while the scheme provided apparently offered an opportunity of advancing stage by stage from the elementary school to a university graduation in agricultural science so far there was no instance of such a career having been passed through. The efforts to promote agricultural education among adult farmers by means of farmers classes, lectures, and demonstrations had been only occasionally successful. It was hoped, if this teachers' farm school proved successful, to hold many such schools throughout the year but devoted to specialization in the various distinct phases of agriculture, such as dairying, cereal culture, fruit growing, sheep husbandry, irrigation farming, etc.

A list of the subjects and demonstrations at this school and extracts from a student's notebook are given.

A manual for laboratory and field studies in agriculture, J. M. Lecato (*Huntington, W. Va.: Author, 1915, pp. 75, figs. 5*).—The 100 exercises in this manual, planned for a year's course consisting of three hours of recitation and four hours of laboratory work a week, relate to forestry, soils, the plant and its propagation, diseases and insect enemies, vegetable gardening, field, forage, and pasture crops, and farm animals, including poultry. The entire equipment necessary for a section of 12 students can be purchased for $100 or less.

Agriculture for school and farm, I, J. M. NAPIER, W. H. BARTON, and W. P. STEWART (*Clemson Agr. Col. S. C., Ext. Div.* [*Pub.*], *1915, July, pp. 129, figs. 35*).—This volume consists of a compilation of questions and answers giving simple information on soils, plants, and animals for use in the elementary schools of South Carolina. It is designed to assist the teacher in learning elementary practical agriculture while teaching it and is also suggested as a text for use in farmers' night schools for adults. A dramatization of a dialogue entitled Agriculture and the Farmer is appended.

Elements of farm practice, A. D. and E. W. WILSON (*St. Paul, Minn.: Webb Publishing Co., 1915, pp. 347, pl. 1, figs. 153*).—This book is a complete revision and extension of the authors' Agriculture for Young Folks (E. S. R., 23, p. 798). It deals largely with common farm practices rather than with scientific principles, and has been prepared primarily for use in rural schools and for elementary classes in other schools. The subjects considered include soils, crops, common weeds and their eradication, the garden, fruit on the farm, plant diseases and insect pests, live stock, feeds and feeding, dairying, poultry, birds, and bees, agricultural engineering, community activities, the farm home, and farm management. Each section is a complete reading lesson followed by questions and examples, so that it may be used to replace a part of the regular reading, language, and arithmetic lessons.

Soils courses at the Iowa State College, P. E. BROWN (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 42–47*).—A description of the laboratory work in soils at the Iowa College is given, together with a brief statement of the development of the soils work at this institution. Prior to 1902 this consisted of one brief course in soil physics, but in that year was organized as a subdivision of the agronomy department with four distinct courses in soil physics, soil fertility, special problems in soil physics, and special problems in soil fertility. These courses have formed the foundation for the present courses, numbering about 30, for undergraduate and graduate students in agriculture, and classified as soil physics, soil fertility, soil bacteriology, soil surveying, and soil management.

The preparation of material for field crops laboratory, W. O. WHITCOMB (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 38–41, pls. 2*).—Suggestions based on a three-year study of the problem at the Montana College, are offered for collecting, pressing, and preparing mounted material for the field-crops laboratory.

Seed testing (*Cornell Rural School Leaflet, 9 (1916), No. 3, pp. 403–413, figs. 5*).—Directions are given for testing seeds for purity and viability and for making the necessary apparatus.

Laboratory experiments on food products, E. H. S. BAILEY (*Philadelphia: P. Blakiston's Son and Co., 1915, pp. VI+44*).—These experiments are designed especially for use with the author's text, The Source, Chemistry, and Use of Food Products (E. S. R., 32, p. 353), but are adapted for use with any course on the composition of food. They deal primarily with the raw and manufactured food materials as found in the field, the market, and the provision store, and enable the student to determine the composition of ordinary food materials and how they are sometimes adulterated and mislabeled.

Twenty lessons on poultry keeping, C. T. PATTERSON (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. X+92, pl. 1, figs. 55*).—This is an elementary treatise prepared under the direction of the American Poultry Association for the use of teachers and pupils in the public schools. The lessons treat of the origin and history, nomenclature, characteristics, breeds and varieties, judging, enemies and diseases, and care and management of fowls.

Tentative outline of agricultural engineering work for Mississippi agricultural high schools, D. SCOATES (*Bul. Miss. Agr. and Mech. Col., 13 (1916), No. 1, pp. 20*).—Classroom and laboratory work is outlined under the subjects of farm machinery, farm power, farm buildings, surveying and drainage, roads, and rural sanitation. The laboratory outline includes references to exercises previously given by the author (E. S. R., 32, p. 597). An extended bibliography is included.

MISCELLANEOUS.

Annual Reports of the Department of Agriculture, 1915 (*U. S. Dept. Agr. Rpts. 1915, pp. V+429*).—This contains the reports of the Secretary and heads of bureaus and other administrative officers. The various reports are also issued as separates.

Federal legislation, regulations, and rulings affecting agricultural colleges and experiment stations (*U. S. Dept. Agr., States Relations Serv., Federal Legislation [etc.] Affecting Agr. Cols. and Expt. Stas. (1915), pp. 35*).—A revision to October 15, 1915, of the circular previously noted (E. S. R., 32, p. 496).

Twenty-eighth Annual Report of Georgia Station, 1915 (*Georgia Sta. Rpt. 1915, pp. 20*).—This contains the organization list, reports by the president of the board of directors and the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1915. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-eighth Annual Report of Illinois Station, 1915 (*Illinois Sta. Rpt. 1915, pp. 27*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1915, brief notes as to the principal lines of work, a list of the publications of the station since its establishment, and a list of those issued during the year.

Director's report for 1915, W. H. JORDAN (*New York State Sta. Bul. 413 (1915), pp. 611–652*).—This contains the organization list and a review of the work and publications of the station during the year.

Twenty-sixth Annual Report of North Dakota Station, 1915 (*North Dakota Sta. Rpt. 1915, pts. 1, pp. 46; [2], pp. 25*).—Part 1 of this report contains the organization list, a report of the director, including an extended report on extension work, and a financial statement for the fiscal year ended June 30, 1915. The experimental work reported is for the most part abstracted elsewhere in this issue.

Part 2 comprises the report of the food commissioner on food, drugs, and sanitation, and is abstracted on page 61.

Plan of work for Trumbull County experiment farm, C. W. MONTGOMERY (*Mo. Bul. Ohio Sta., 1 (1916), No. 4, pp. 119–122*).—The plan of work being followed is outlined.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta., Mo. Bul., 3 (1916), No. 12, pp. 16; 4 (1916), No. 1, pp. 16, figs. 8*).—These numbers contain brief articles on the following subjects:

Vol. 3, No. 12.—Some Hog Raising Experiments, by W. A. Linklater (see p. 68); Spring Spraying Suggestions for Western Washington, by J. L. Stahl; The Succulent Feed Supply (see p. 69), by E. B. Stookey; and Care and Management of Baby Chicks (see p. 69), by Mr. and Mrs. G. R. Shoup.

Vol. 4, No. 1.—Trapping Moles and the Possible Utilization of Their Skins, by T. H. Scheffer; Feed and Care of the Calf for the Dairy, by H. L. Blanchard; Tillage, by E. B. Stookey; and Mites and Lice, by Mr. and Mrs. G. R. Shoup.

NOTES.

Arizona University and Station.—On July 1 active work was begun on a new substation in the Salt River Valley consisting of 160 acres in the vicinity of Mesa. This farm will constitute the main point for experimental work in the irrigated part of the State and will be devoted to experiments in horticulture, agriculture, and animal husbandry. A residence, barns, and stock pens are to be constructed.

R. H. Forbes, who has been pursuing graduate work at the California Citrus Station for the past year, received the degree of Doctor of Philosophy from the university in May. P. W. Moore has been appointed assistant in plant breeding.

Arkansas University and Station.—P. B. Barker, associate professor of farm crops in the extension service of the University of Missouri, has been appointed head of the department of agronomy and has entered upon his duties. W. E. Ayres has been appointed assistant in agronomy, chiefly for work in cotton investigations.

California University.—The agricultural extension division is giving a course of 14 agricultural lectures in cooperation with the San Francisco Y. M. C. A., with the object of pointing out to city men and women contemplating a change of occupation from the city to the country certain elementary facts that, when fully considered, should help toward success in the new environment. The attendance at these lectures is ranging between 500 and 550.

The division of landscape gardening and floriculture, in response to a growing demand for suggestions concerning landscape improvement and development of school grounds, has assembled a collection of sketch plans and blue prints representing actual problems in school-ground design as they have been worked out for various schools in the State. Many of the designs are in color, while others are actual working planting plans with plant lists attached. They have been selected primarily to illustrate correct principles of landscape design as they may be applied in the systematic development of school grounds of various sizes. The collection is being sent to educators for study or exhibitions upon request.

According to a note in *Science*, Frank Adams has been appointed professor of irrigation investigations. He will also continue his work with the Office of Public Roads and Rural Engineering of this Department.

Connecticut College.—*New England Homestead* announces that the Gilbert estate at Georgetown, bequeathed to the college in 1906 (E. S. R., 17, p. 717), is to be opened as a practical farm school. No formal lectures are to be given but practical work will be given in the fields, dairy, poultry plant, and garden. Applicants must be at least 16 years of age and residents of the State. Not more than from 10 to 12 students can be accommodated at present, although it is hoped ultimately to take as many as 30. George Eaton has been appointed principal of the school.

Delaware College and Station.—W. A. Lintner, assistant professor of agronomy and assistant agronomist, has resigned to engage in commercial work.

Georgia College.—Recent appointments include Dr. T. S. Leith as instructor in veterinary medicine, W. O. Collins as instructor in soil chemistry, W. H. Collins as instructor in agronomy, C. N. Wilder as tutor in chemistry, Pope R. Hill as fellow in agronomy, and J. F. Hart, jr., as general field agent in the extension department.

Iowa College.—M. R. Tolstrup, assistant professor of dairying, has been appointed in charge of the department of markets of Vermont in the office of the State Commissioner of Agriculture. The work is to be conducted in cooperation with the Office of Markets and Rural Organization of this Department.

Kansas College.—Chas. L. Quear has been appointed research assistant to President Waters.

Kentucky Station.—W. V. Smith has resigned as assistant animal husbandman, L. R. Himmelberger as associate in hog cholera serum production, and H. K. Wright as assistant in hog cholera work. N. R. Elliott has been transferred from assistant in horticulture to extension work in horticulture and has been succeeded by A. L. Olney. O. S. Crisler and W. H. Simmons have been transferred from the department of diseases of live stock, the former to extension work and the latter as dairy inspector in the food and drug department.

Maine Station.—John A. Perry, William R. Rich, and Walter W. Webber have been appointed assistant chemists beginning July 1, vice Elmer R. Toby, Edward E. Sawyer, and Walter H. Rogers, all of whom have resigned to engage in commercial work.

Massachusetts College.—A conference of Massachusetts bankers was held at the college May 24 and 25 with an attendance of about 40. The object was to present to the bankers of the State information regarding the new outlook for agriculture and its possibilities and significance. President Butterfield, C. W. Thompson, of the Office of Markets and Rural Organization of this Department, and Edward F. Howell, managing director of the New York State land bank, were among the speakers.

Missouri University and Station.—During the university summer session, from June 8 to August 4, 18 courses in agriculture which are accredited in the four-year course and three in forestry will be offered. Of these agricultural courses, nine are required of students for graduation, two of which are farm management field studies. The arrangement makes it possible for the teacher who is a candidate for the degree in agriculture to take all the required courses in agriculture during the summer session. In addition there are general agricultural courses for teachers only.

The number of resident students which have received instruction in the college of agriculture during the present year is 954, of whom 637 are in the four-year course, 266 in the short course, and 51 graduate students.

W. W. Swett has been appointed instructor in dairy husbandry.

Montana Station.—R. R. Dodderidge, assistant in animal husbandry, resigned in May to take up the management of a farm.

Nevada Station.—A detailed technical study is contemplated of the feeding value of the white sage, *Eurotia lanata*, its manner of spreading and distribution in nature, and methods of management which will restore depleted white sage ranges. A cooperative study of biting flies of cattle on the ranges will also be undertaken this summer, preliminary arrangements having been made with the Bureau of Entomology of this Department.

New Mexico College and Station.—E. H. Divelbiss resigned June 1 as assistant horticulturist in the station to become county agent for Chaves County. J. W. Rigney, until recently county agent for that county, has been appointed assistant horticulturist.

New Jersey Stations.—William S. Porte, research assistant in plant breeding, and W. N. Cowgill have resigned, the former to become instructor in agriculture in the Somerville, N. J., High School. John W. Bartlett, field assistant in horticulture, has been appointed extension specialist in dairy husbandry and has been succeeded by Ralph M. Hubbard. J. B. R. Dickey has been appointed extension specialist in soil fertility, and William H. McCallum state leader of boys' clubs.

Cornell University and Station.—Press reports announce the resignation of Dr. B. T. Galloway as dean and director. H. B. Knapp, extension professor in pomology, has resigned to take charge of the new state school of agriculture of Schoharie County.

New York State Station.—Governor Whitman has approved a bill appropriating $30,000 toward the construction of a $100,000 administration, library, and demonstration building. Appropriations have several times been granted for this building by the legislature but have previously been vetoed by the governors.

North Carolina College and Station.—W. C. Riddick, vice-president and professor of civil engineering, has been appointed president of the college. H. L. Cox, assistant chemist in the station, has resigned to engage in commercial work and has been succeeded by L. B. Johnson, a 1916 graduate of the college.

Results recently obtained by the division of animal husbandry at the Iredell substation indicate that it pays to winter sheep in that section on open pasture rather than with corn silage. The cost of wintering the two lots was practically the same, but the ewes wintered on pasture came out in the spring in much more thrifty condition and had made four times as much gain. A corral and shed were found to be necessary for protection at night and in inclement weather.

Ohio State University.—Beginning July 1, the work in soils is to be transferred to the department of agricultural chemistry and the department of agronomy will be abolished. The work in field crops will be maintained as a distinct department. Dr. J. F. Lyman, professor of agricultural chemistry, has been granted a year's leave of absence, a portion of which will be spent in graduate work at Yale University.

Applications for the agricultural correspondence course, offered for the first time this year, numbered 6,348, of whom but 4,644 could be accommodated. An enlargement of the work is planned for the ensuing year.

Oregon College and Station.—At the 1916 summer school, 89 courses are being offered in various college subjects, with 53 members of the faculty, as well as outside specialists, scheduled as regular instructors, lecturers, and officers.

At the Southern Oregon substation a study of pear blight resistance is being carried on under the direction of F. C. Reimer. He is said to have secured, with the assistance of other station authorities, the largest and most comprehensive pear variety collection in the country.

The uniform marketing plan for horticultural products, suggested by the Office of Markets and Rural Organization of this Department, is to be put into operation in Oregon under the direction of the college, assisted by the Portland Chamber of Commerce. The work of organization will be conducted for the college by Dr. Hector MacPherson, head of the bureau of farm organization and management. The physical handling of the fruit and vegetables will be in charge of Prof. C. I. Lewis. An active campaign is now under way to enlist the growers in this movement.

Pennsylvania College and Station.—Ambrose N. Diehl, of Duquesne, and A. W. Mitchell, of Erie, have been appointed to the board of trustees, vice Andrew Carnegie and William H. Walker. C. W. Larson, head of the department of

dairy husbandry, and M. F. Grimes, assistant in animal husbandry, have resigned, the former to accept a position with Columbia University and the latter a position with the Delaware College. Recent appointments, effective July 1, include E. R. Hitchner as instructor in bacteriology, and W. W. Wood as instructor in agricultural extension; and effective September 1, J. W. Miller as teaching fellow in botany, and G. M. Shisler as assistant in agricultural chemistry.

Porto Rico College.—R. L. Clute, for about thirteen years instructor in agriculture in the Philippine Normal School and agricultural inspector at Manila from 1907 to 1911, has been added to the agricultural faculty.

Tennessee University and Station.—The forty-third annual meeting of the East Tennessee Farmers' Convention was held at the station May 16 to 18 with a total attendance of about 4,000. Following the convention a sale of Aberdeen-Angus cattle was held under the auspices of the American Aberdeen-Angus Breeders' Association, 47 animals bringing an average price of $243. This is the second public sale held in conjunction with the convention and the first of this breed. H. R. Duncan, instructor in animal husbandry, resigned June 15 to engage in farming.

Virginia College and Station.—Dr. A. W. Drinkard, jr., associate horticulturist, has been appointed director of the station. W. J. Schoene, acting director for the past two years, will continue as state entomologist and entomologist of the station. Jesse M. Jones, of the States Relations Service of this Department, has been appointed director of the extension service.

West Virginia University and Station.—A tract of land, comprising about 20 acres adjoining the station farm, has been purchased for development as a poultry plant. This will be available for instruction purposes in the college of agriculture, as a source of eggs and fowls in connection with boys' and girls' club work, and for poultry studies in the station.

Wyoming University and Station.—So much demand has been expressed by sheep men of Wyoming for special help in their problems that the college of agriculture has arranged to have Prof. John A. Hill devote one-half of his time to extension work in this field.

Director H. G. Knight, now on leave of absence for research work at the University of Illinois, will return to the station September 1. Dr. S. K. Loy, half time research chemist, will be transferred entirely to instruction work on the same date. Dr. E. H. Lehnert has been appointed station veterinarian vice Dr. O. L. Prien.

Convention of Milk Producers and Other Dairy Interests of the United States.—This convention was held in Washington, D. C., May 5 and 6, under a call issued by the National Dairy Council and the National Dairy Union. About 200 delegates from 31 States were in attendance, representing 91 dairy, live stock, and farm organizations. The object of the conference was announced as "to develop uniform practical regulations governing the production and care of dairy products." William T. Creasy, secretary of the National Dairy Union, served as temporary chairman of the conference, and M. D. Munn, president of the National Dairy Council, was chosen permanent chairman, N. P. Hull, president of the National Dairy Union, vice-chairman, and Mr. Creasy, secretary.

In the opening address Mr. Creasy called attention to various problems confronting the dairy interests of the country. He advocated the formation of a national council of all agricultural interests with headquarters at Washington.

An address of welcome was made by Hon. Carl Vrooman, Assistant Secretary of Agriculture, in which he spoke especially of the benefits of government regulation. Such regulation, in his opinion should be based upon the fundamental principle that the public interests are paramount to any private interests, and

should be practical, discriminating, and well digested. Mr. Munn responded to this address, outlining some of the work of the conference and discussing the relations of this Department with the dairy interests of the country.

The address of Mr. Hull urged farmers and dairymen to take a more active part in shaping the regulations that surround their business. He cited as handicaps to profitable milk production the lack of uniformity in milk regulations and methods of inspection and the high cost of distributing milk and cream.

Dr. H. A. Harding, of the Illinois University and Station, discussed the standardization of conditions under which milk and cream are handled from the producer to the consumer, particularly as affecting interstate shipment. He maintained that clean milk could be produced under relatively inexpensive conditions, referring to recent studies indicating that the barn and the cow are relatively unimportant sources of bacteria in dairy products as compared with the dairy utensils and the maintenance of proper temperatures during milk transportation.

In an address on Pasteurization in the Dairy Industry, Prof. O. F. Hunziker, of the Purdue University and Station, contended that the integrity and future progress of the dairy industry depend upon pasteurization. He reviewed experiments showing that pasteurization at 145° F., holding process, somewhat improved the digestibility of milk, and that pasteurization at low temperatures accentuates and deepens the cream line and hastens the rising of cream. The pasteurization of both milk and cream he deemed largely an economic question, as pasteurized milk may be more easily kept sweet until placed in the consumer's pantry and pasteurized cream produces butter of better quality.

B. H. Rawl, chief of the Dairy Division of this Department, discussed the Utilization of Surplus Dairy Products. He stated that only a few localities have a surplus at present, but that the rapid growth of the industry makes it necessary to give consideration to methods for increasing the demand. He called attention to the desirability of building up an export business and described in detail methods of increasing domestic consumption. He advocated developing the cheese industry in sections suitable for the business, such as the irrigated regions of the West and the mountainous sections of the Southeast, and pointed out opportunities for high-grade butter and milk production.

W. J. Kittle, secretary of the Northern Illinois Milk Producers' Association, L. J. Taber, master of the Ohio State Grange, and J. J. Farrell, Dairy and Food Commissioner of Minnesota and president of the National Creamery Buttermakers' Association, discussed forms of legislation, milk regulations, and inspection problems. G. L. McKay, secretary of the American Association of Creamery Butter Manufacturers, considered Legal Standards for Butter.

Resolutions were adopted by the convention favoring immediate and comprehensive studies by this Department and the experiment stations of contagious abortion, measures to control more fully tuberculosis in dairy herds, and the formation of a bureau or office in this Department to deal exclusively with dairy cattle and the dairy industry. The appointment by the Secretary of Agriculture of a committee of producers, dealers, and sanitary officers to frame a set of rules and regulations covering milk production and handling and to urge their adoption by States and cities was also favored. Other resolutions advocated the labeling of all dairy products in the production of which foreign fats had been used, experimentation with denatured alcohol, and the closer union of agricultural interests in cooperative legislative effort.

Series of Lectures on Nutrition.—A series of illustrated lectures on nutrition was given under the auspices of the Washington Academy of Sciences at the New National Museum as follows: April 7, The Basal Food Requirements of Man, by Dr. Eugene F. Du Bois; April 14, Nutrition and Food Economics, by

Dr. Graham Lusk; April 21, Investigations on the Mineralogical Metabolism of Animals, by Dr. E. B. Forbes; and April 28, The Relation of Vitamins to Nutrition in Health and Disease, by Dr. Carl Voegtlin.

New Journals.—The *Journal of Bacteriology* is being published bi-monthly as the official organ of the Society of American Bacteriologists. It will contain original articles and abstracts of papers read at meetings of the society and of other bacteriological literature.

The papers in the initial number include The Genesis of a New Science—Bacteriology, by W. T. Sedgwick; The Pedagogics of Bacteriology, by D. H. Bergey; Further Studies on Bacterial Nutrition; The Utilization of Proteid and Nonproteid Nitrogen, by L. F. Rettger, N. Berman, and W. S. Sturges; Studies on Soil Protozoa and Their Relation to the Bacterial Flora, I, by J. M. Sherman; A Culture Medium for Maintaining Stock Cultures of the Meningococcus, by G. G. A. Roos; and Bile Compared with Lactose Bouillon for Determining the Presence of *B. coli* in Water, by M. M. Oost.

Addisonia is a new quarterly journal published by the New York Botanical Garden under a bequest by the late president of the garden, Judge Addison Brown. This bequest provides for the establishment and maintenance of a magazine to be devoted exclusively to the illustration by colored plates of the plants of the United States and its territorial possessions, and of other plants flowering in the garden, together with brief popular descriptions and similar data. The initial number contains plates and descriptions of 10 plants.

Miscellaneous.—At a recent meeting of the State Commissioners of Agriculture and others, held in Washington, D. C., a permanent organization was effected under the name of National Conference of Commissioners of Agriculture and the following officers: President, E. J. Watson, of South Carolina; vice-president W. P. Guptil, of Maine; and secretary-treasurer, Clarence J. Owens, of Washington, D. C.

The department of physics at the Ontario Agricultural College has been divided, W. H. Day continuing at the head of the department, and in charge of studies of evaporation, cold storage, farm power, farm water supply, ventilation, etc. J. R. Spry has been appointed in charge of the farm drainage campaign.

Dr. Alfred E. Cameron, of the University of Manchester, has been appointed field officer of the entomological branch of the Canadian Department of Agriculture, and will study pear thrips and other insects in British Columbia.

Prof. William J. Beal, formerly professor of botany at the Michigan College, was granted the degree of doctor of agriculture by Syracuse University at its recent commencement.

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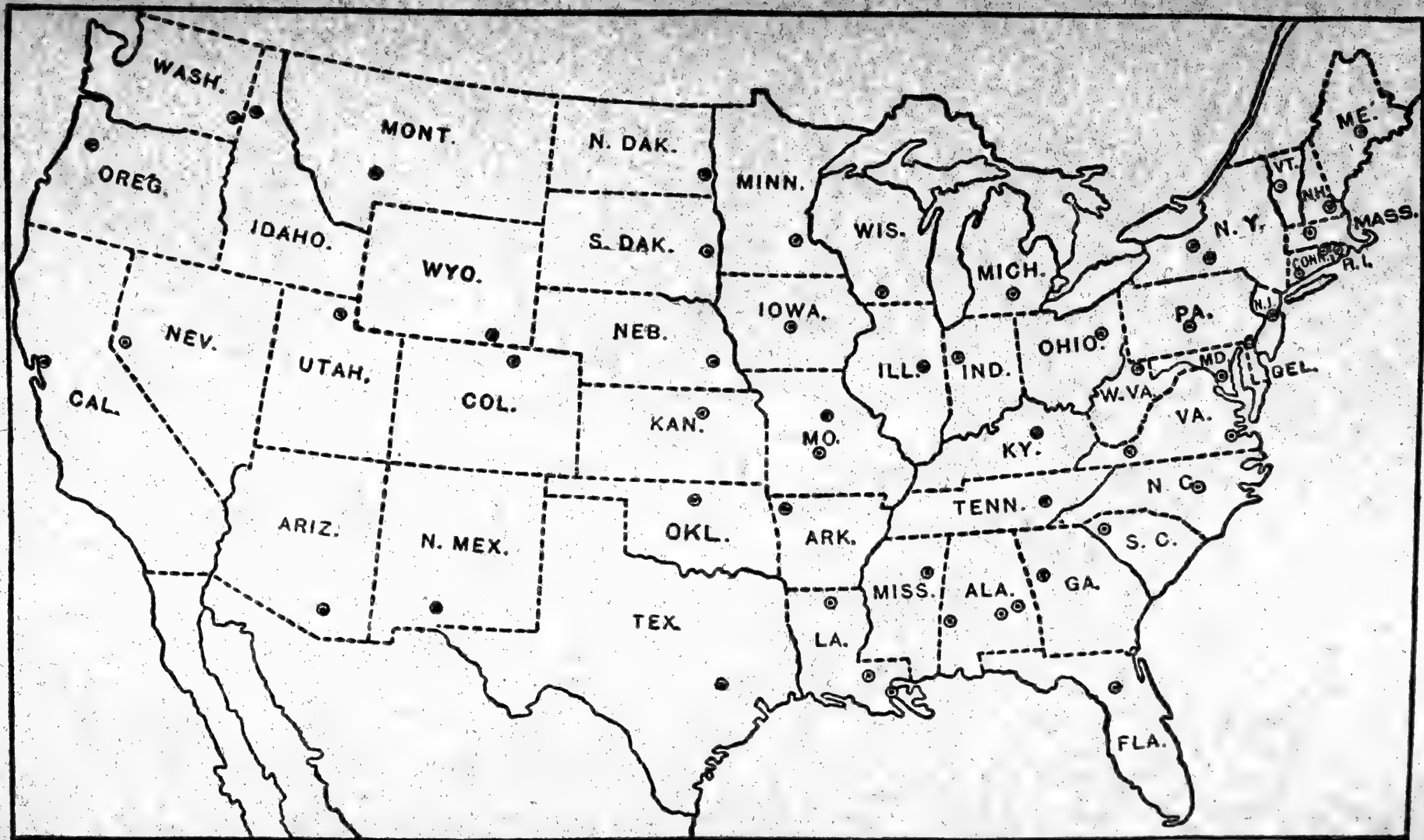
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U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
A. C. TRUE, DIRECTOR

Vol. 35 AUGUST, 1916 No. 2

EXPERIMENT STATION RECORD

WASHINGTON
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1916

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[a] Director. [b] Agronomist in charge. [c] Acting director.

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ANIMAL PRODUCTION.

RURAL ECONOMICS.

AGRICULTURAL EDUCATION.

MISCELLANEOUS.

LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

[a] Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

VOL. 35. AUGUST, 1916. No. 2.

Since the passage of the Smith-Lever Extension Act in 1914, no agricultural question, among the many pending before Congress, has aroused more widespread interest than that of the provision of more adequate rural credit facilities. During this period, scores of bills, embracing a broad range of remedies, have been proposed. Commissions, both State and National, official and unofficial, as well as the United States Government, the agricultural colleges, organizations, and individuals have studied the subject in its various phases in this country and abroad. At length, public opinion has sufficiently crystallized to make possible the enactment of a law designed to initiate a Federal system of rural credit based upon farm real estate, and the result is the Federal Farm Loan Act, approved July 17 by President Wilson.

The passage of legislation of this sort constitutes a notable recognition of American agriculture in a new direction. By the establishment of the Federal Department of Agriculture and the system of agricultural colleges and experiment stations and the provision, for many years, of large appropriations to carry on and extend the activities of these institutions, the principle of Federal aid to agriculture through such means as education, systematic research, and the demonstration of improved methods has become firmly accepted. The new legislation, however, recognizes more definitely than ever before that agriculture is a basic industry, one in which knowledge and skill alone are not sufficient for success, and that it is highly important that farmers obtain the capital they need on terms consistent with their credit.

That they have not always been able to do this was indicated by President Wilson in his message of December 7, 1915, advocating the provision of "adequate instrumentalities on which long credits can be obtained on land mortgages," and likewise in a speech made when signing the Act, in which he said: "The farmers, it seems to me, have occupied hitherto a singular position of disadvantage. They have not had the same freedom to get credit on their real assets that others have had who were in manufacturing and commercial enterprises,

and while they sustained our life they did not in the same degree with some others share in the benefits of that life." The creation by the Federal Government of a distinctive rural credit system is thus a recognition of the needs of agriculture in this direction, and an indication of the belief that to render assistance in meeting these needs will be to fulfill a function which will "promote the general welfare."

Although the machinery through which it is proposed to carry on the new system does not directly include the agricultural colleges and experiment stations, many agricultural economists and other college and station workers have been active in studying the problem, and the passage of the Act is to them, as to all associated with agriculture, an event of much interest. This could not be otherwise, in view of their close touch with farm life. Instruction staffs engaged in preparing students for agricultural service have repeatedly been brought face to face with the obstacles confronting their graduates who wish to farm but have only limited capital. Experiment station and extension workers have often been handicapped in recommending such sound and simple remedies for specific problems as an increase in the farm business by the purchase of additional land or live stock, the drainage of wet areas, the construction of a silo, and the like, by a realization of the impossibility of the farmers securing the necessary capital without excessive interest rates and commissions, uncertainty as to the renewal of short-term mortgages, and kindred difficulties.

The provision of adequate rural credit facilities would thus widen the opportunities of the college and station staffs for usefulness, and render their work more effective and far-reaching. Many of the undertakings for which the farmer will wish to utilize his new resources will involve matters with which he is unfamiliar, such as the details of silo construction or of farm drainage or the selection of pure-bred live stock, and he will often turn to the county agent for assistance. In some cases the borrower's plans may not be of the wisest, and the adviser must endeavor to prevent extravagance and waste. Thus the introduction of a new system will bring its own problems to the colleges and stations, and upon them, accordingly, will rest a measure of responsibility for its success.

The history of the movement resulting in this legislation is interesting, partly from the fact that it is of such comparatively recent origin. It is one of many evidences of a new viewpoint and attitude toward the business of farming.

With the passing away of what may be termed the pioneer or formative period of American agriculture toward the close of the nineteenth century, the need of an efficient system of financing agri-

culture began to be more and more realized. By this time free land had largely disappeared, and land values began to be more definite and stable. Farmers came to appreciate the value of well-planned irrigation or drainage programs, systems of clearing and improving land, more definite systems of road construction, proper building programs, and better and more equipment on farms. The lack of funds in many sections with which to carry out these and other projects of obvious advantage emphasized and strengthened the demand for more adequate credit facilities.

According to the Census of 1910, 33.6 per cent of farms operated by their owners in the United States were mortgaged. The mortgages averaged $1,715 each, or 27.3 per cent of the value of the land and buildings of the farms mortgaged. The total amount of the mortgages on farms operated by their owners was slightly over 10 per cent of the value of the land and buildings of all farms of this class. On this basis the aggregate farm mortgage indebtedness of the country has been estimated to be about $3,600,000,000. An inquiry instituted by the United States Department of Agriculture in 1913 indicated that of this amount about one-fifth was supplied by banks, about one-fifth by life insurance companies, and the remainder by mortgage companies and private individuals. A large part of this sum was loaned for relatively short periods, usually from three to five years. Much variation in interest rates and commissions was found in the different sections of the country. The Department reported a range in the percentage of the farm mortgage business on which commissions were paid from 1.3 per cent of the total in Connecticut to 91.6 per cent in Oklahoma, and an average rate for interest and commission ranging from 5.3 per cent in New Hampshire to 10.5 per cent in New Mexico. In many individual cases the rates for interest and commission were far in excess of these figures.

In 1910, the American Bankers' Association appointed a committee to study the general subject of farm finance in this country. The report of the Secretary of Agriculture for 1912 contained the results of a questionnaire sent out to country bankers, farmers, and merchants as to the prevailing local conditions, while in the same year the collection of data as to European methods was undertaken by the State Department and some of its findings submitted by President Taft to the House of Governors.

In April, 1912, a conference on cooperative credit was held at Nashville, Tennessee, under the auspices of the Southern Commercial Congress. This congress undertook to assemble a commission of representatives from each State to study cooperative systems in Europe. The commission was known as the American Commission, and consisted of sixty-seven members from twenty-nine States, the District

of Columbia, and the Dominion of Canada. Early in 1913 it was supplemented by the United States Commission of seven members, authorized by Congress to work in cooperation with it, as previously noted (E. S. R., 28, p. 301). A three months' study was made by the two commissions of agricultural credit and cooperation in fourteen countries of Europe, followed by elaborate reports and the submission of a proposed land credits bill.

The first Federal legislation providing improved rural credit facilities was embodied in the Federal Reserve Act of December 3, 1913. This Act contained more liberal provisions than had previously obtained as to the discounting of agricultural short-time loans, and also empowered the national banking associations, under certain restrictions, to make loans on improved and unencumbered farm land. These real estate loans were, however, restricted to 50 per cent of the value of the property and in duration to five years.

In March, 1915, the Senate and House each adopted a rural credits amendment to the agricultural appropriation bill, but in conference both of these propositions were eliminated and a joint congressional committee provided to study the subject further and suggest legislation. This committee subsequently submitted a bill which, after amendment, passed the Senate May 3, and the House May 15, 1916. After a considerable period in conference, the measure became a law July 17. It is evident, therefore, that the legislation is not hasty but that time has been taken for study of the question and the adaptation of a system to American conditions.

The complete title of the new measure is "An act to provide capital for agricultural development, to create standard forms of investment based upon farm mortgage, to equalize rates of interest upon farm loans, to furnish a market for United States bonds, to create Government depositories and financial agents for the United States, and for other purposes." This title indicates its general scope and comprehensiveness.

The act provides for a Federal Farm Loan Board, a system of Federal land banks, National farm loan associations, and joint-stock land banks. Some of these component parts correspond to a certain extent to institutions which have proved successful in Europe and elsewhere, and some of the principles incorporated are analogous to those followed in many of the building and loan associations developed in numerous urban sections of this country. In form the measure is also patterned in a general way after the Federal Reserve Act, and while the system proposed is essentially distinct as to administrative purposes it is designed to supplement and articulate with the Federal reserve system.

The Federal Farm Loan Board is given supervision over a Federal Farm Loan Bureau, to be established in the Treasury Department and to have charge of the execution of the act. The board is to consist of the Secretary of the Treasury, ex-officio, and four other members to be appointed for terms of two, four, six, and eight years, respectively, in the beginning, and thereafter of eight years each, at salaries of $10,000 per annum. The initial appointments consist respectively of Messrs. Charles E. Lobdell, of Kansas; George W. Norris, of Pennsylvania; William S. A. Smith, of Iowa; and Herbert Quick, of West Virginia. One of these members is to be designated as the farm loan commissioner, and will be the active executive officer of the board. The board is to charter the Federal land banks, the National farm loan associations, and the joint-stock land banks, and has general supervision and control over the entire system. It is also to prepare publications relative to the act, the principles of rural credit, and the like, and to disseminate its results, through the United States Department of Agriculture or otherwise.

The United States is to be divided by the board on a basis of State lines and the farm loan needs of the country into twelve land bank districts. Each district may contain a Federal land bank and branch offices as needed. A capital stock of $750,000, divided into shares at $5 each, is required for each of these banks, but it is provided that if this is not subscribed by the public within thirty days the Government must purchase the unsubscribed portion of the stock. The funds thus secured, together with a special appropriation of $100,000 for the expenses of the farm loan board, are expected to be available to initiate the new system.

The National farm loan associations, which are distinctive local organizations, are to be chartered by the Federal farm loan board upon the recommendation of the district land bank. Membership in these associations is restricted to actual or prospective owners of farms in a given locality who wish to borrow upon farm mortgage security. At least ten such persons are required and their individual borrowings must not be less than $100 nor more than $10,000 and must aggregate at least $20,000.

The loans when granted are made by the district land bank to the individual members of the association through its secretary-treasurer. The amount can not exceed 50 per cent of the value of the land, based principally on its earning power, plus 20 per cent of the value of the permanent insured improvements. The loan can be negotiated only for the purpose of purchasing land for agricultural uses, the purchase of equipment, fertilizers, and live stock necessary for the farm operations, the provision of buildings or the improvement of farm lands or the liquidation of existing indebtedness.

Loans are to be made upon first mortgage security, for periods of from five to forty years, with interest at not to exceed 6 per cent, and with payments on the amortization plan. This provision is intended not only to enable the farmer to secure loans conveniently and at rates he can afford, but to protect him in these loans from the necessity of heavy costs, bonuses, and commissions, and to extend the period of payment over a long period of years without the necessity of uncertain and costly renewals at stated periods. At the same time, opportunity is given for payments, in addition to those required, on installment dates after the expiration of five years, thereby encouraging thrift and allowing the borrower to profit by favorable conditions.

In order to obtain funds to make the loans, the Federal land banks, upon the approval of the farm loan board, are empowered to issue farm loan bonds based upon the mortgages obtained through the farm loan associations. These bonds may be issued in denominations ranging from $25 to $1,000 and in series of at least $50,000, and are to bear interest payable semi-annually at a rate not to exceed 5 per cent per annum.

The farm loan associations are essentially mutual and cooperative, each member being required to subscribe for stock to the extent of 5 per cent of his loan. This stock is held by the association as collateral security until the payment of the loan, at which time it is retired at par. In the meantime the borrower has received his proportionate share of any dividends from the operations of the association. A similar arrangement is also required between the associations and the Federal land banks.

Shareholders in the associations are held individually responsible, equally and ratably, but not for one another, for the liabilities of the association to the extent of the par value of their stock, plus the amount paid in and represented by their shares. It is, therefore, a plan for limited liability of members as contrasted with the assumption of unlimited liability which constitutes an essential feature of a number of the European systems.

Inasmuch as inability to organize farm loan associations might work hardship upon individual borrowers, provision is also made whereby, after the act has been in effect a year, the Federal land banks may make loans through other channels. If no farm loan association has been, or is likely to be, formed in a locality the land bank may employ an incorporated bank, a trust company, a savings institution, or a mortgage company as its agent in arranging the loans and in collecting payments. The agent must endorse all loans negotiated and may receive actual expenses and a commission not to exceed 0.5 per cent per annum. The borrower in these cases sub-

scribes for stock in the land bank itself and receives dividends accordingly.

Another alternative is provided in the joint-stock land banks. These banks are to possess some powers similar to those of the Federal land banks, but differ from them in a number of ways. They must have a subscribed capital of at least $250,000, none of which comes from Government funds. These banks are allowed to make loans on first mortgages on farm lands, and to issue a distinctive series of farm loan bonds to an amount not exceeding fifteen times their capital and surplus. Their interest rate can not exceed by more than one per cent the rate charged on their land bonds, or a total of 6 per cent, and any commissions collected must have the approval of the farm loan board. In making the loans the joint-stock land banks, however, need not restrict the purposes for which the loans are to be used or the amount to an individual, or require the borrower to be personally engaged in the cultivation of the land mortgaged. The banks are also noncooperative, no stock subscriptions being required of borrowers and any profits being apportioned among the shareholders alone.

The mortgages received and the bonds issued under the authority of the act, whether by the Federal land banks or the joint-stock banks, are specifically exempted from Federal, State, and local taxation. The bonds are also made legal investments for all fiduciary and trust funds, and may be bought and sold by member banks of the Federal reserve system. It is expected that, because of these advantages and their standardized character, these securities will prove attractive investments and thus provide the bulk of the funds to be loaned under the system.

The new act may well lead to an expansion of the influence of the agricultural colleges and experiment stations, and constitute an aid in putting into effect better methods and practices. It should make it practicable for a larger proportion of college graduates to engage in farming. It should also make the work of the county agents more effective, and give an increased impetus to the work of investigation which aims at improvements to be inaugurated by the individual farmer. At all events, it is a response to a widespread demand arising from what is believed to be a necessity, and a logical step toward better agriculture and better farming conditions. Operations under its provisions will, therefore, be awaited with keen and widespread interest.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The starches of the grain sorghums, C. K. FRANCIS and O. C. SMITH (*Oklahoma Sta. Bul. 110 (1916), pp. 3–38, figs. 21*).—This bulletin reports the results of a detailed microscopical study of the grain sorghums. The apparatus and methods used for making the photomicrographs are described in detail. A new apparatus devised by the authors for the determination of the gelatinizing temperature of the starches by means of a thermo-slide is also described in detail and illustrated by drawings.

The quantity of starch found in the different sorghums was fairly uniform, Kafir corn containing 63.6 per cent, White milo maize 64.8, Yellow milo maize 63.1, feterita 63.8, and darso 63.7 per cent.

The following averages of triplicate determinations of the gelatinizing temperatures of the various starches are submitted: White kaoliang, 78° C.; Brown kaoliang, 76.3°; feterita, 75.5°; Orange Cane sorghum, 72.4°; Red Kafir corn, 75°; White Kafir corn, 72.2°; Pink Kafir corn, 64.7°; White milo maize, 74.1°; Yellow milo maize, 76.9°; darso, 72.9°; and Sudan grass, 72.5°. The results obtained by the new thermo-slide procedure checked very closely with those obtained by the water-bath methods.

Photomicrographs, together with detailed descriptions of the following characteristic reactions of the starch grains are submitted: Chloral-hydrate iodin, chromic acid, ferric chlorid, gentian violet, pyrogallic acid, and safranin reactions. The starches examined were those of the White, Red, and Pink Kafir corn, White and Yellow milo maize, Brown and White kaoliang, feterita, darso, Sudan grass, Orange Cane sorghum, corn, sweet potato, Irish potato, rice, arrowroot, navy bean, and wheat.

Tables submitting data of the comparative size of the starch granules of the grain sorghums and the comparative staining values of various starches are included.

It is indicated that "feterita, the milos, and Kafir, containing about 64 per cent starch, seem to be especially suitable as raw materials for the manufacture of high-grade starch by the commercial processes, and if they are used will require practically no change in the machinery now in common use for manufacturing starch from corn."

The variations of gluten, MARCHADIER and GOUJON (*Ann. Sci. Agron., 4. ser., 4 (1915), No. 1–6, pp. 7–19*).—The composition, changes, and variations in amount of gluten in various flours are briefly discussed.

It is indicated that when rye flour is added to wheat flour the amount of gluten is diminished, while the acidity is greatly increased. Rye flour which yields no gluten possesses a normal acidity ten times greater than that of wheat flour. Acetic acid oxidizes and dehydrates gluten, and when a wheat flour which yields a gluten-gliadin ratio of 1:3 is treated with this acid a gluten with a ratio of 1:1 is obtained.

Development of sugar and acid in grapes during ripening, W. B. ALWOOD ET AL. (*U. S. Dept. Agr. Bul. 335 (1916), p. 28*).—Continuing the work previously noted (E. S. R., 25, p. 504) this bulletin embodies the results of a further

and more extended examination, during 1911 and 1912, of the changes in the sugar and acid content of several varieties of grapes. The examinations were made at Sandusky, Ohio, and Charlottesville, Va.

Analytical results obtained from the juice samples submitted indicate that "the total acid percentage is practically the same in the green fruit of Concord in both juice and whole-fruit samples, and this relation continues so nearly throughout the entire period that either result may be taken as fairly expressing the content. The total acid is decidedly higher in the juice sample of green Catawba than in the whole fruit for the first three samples taken; then the acid content of both samples becomes about what may be expected of check samples.

"The results for total tartaric acid in the juice and whole fruit are not so uniform as for total acid. Yet for the Concord samples . . . there is a degree of uniformity which is striking, considering the difficulty of sampling. . . . The Catawba samples show much difference in the green fruit, but the later samples approach uniformity.

"There is a striking dissimilarity in the percentage of tartaric acid for the Concord samples at Sandusky and Charlottesville throughout the period of investigation. Those taken at Sandusky show much less variation than the Charlottesville samples and the former show approximately the same amount at the close of the season as for the partly colored samples first taken, while the Charlottesville samples show a very marked decline in tartaric acid for both the juice and fruit samples. . . .

"It would appear that the crushed fruit invariably yields decidedly the greater part of the free tartaric acid content when pressed. . . . These results support our previous determinations and show that the Concord juice loses free tartaric acid more completely than the Catawba.

"The results for cream of tartar show that in every instance save one the juice sample carries a smaller percentage of cream of tartar than the whole fruit. . . . The excess, in per cent, of cream of tartar in the whole fruit is sufficient to support a previous statement that this substance exists as crystals and that some of these are retained in the pulp when the fruit is pressed.

"The constant increase of cream of tartar both in the juice and fruit samples follows naturally from the disappearance of free tataric acid."

The composition of the whole fruit was also studied. "The volume and weight of the Concord berries did not show marked changes in size of the fruit throughout the period of the examinations of the samples, but for Catawba there was a decided increase of about 39 per cent in volume and about 44 per cent in weight. It appears that this late-maturing variety for that season shows considerable change in size and weight of berries during the period from coloring to maturity.

"On calculating the actual weight of acid in grams present for each sample of 100 berries examined there is shown in a positive manner . . . a fairly constant diminution in total weight of this ingredient. . . . There are some apparently abnormal results; that is, during some periods the actual weight of acid increased slightly, yet this is invariably reversed for the subsequent analysis and the comparison of the first samples and the last taken show a positive loss in total weight of acid present in 100 berries for all the crops analyzed. The data appear to establish the fact that there is a very decided loss in total weight of acid as the fruit ripens."

The analytical data are presented in detail in tabular form.

The urease of soy beans, W. C. de Graaff and J. E. van der Zande (*Chem. Weekbl., 13 (1916), No. 10, pp. 258–264*).—From the results of their investiga-

tions the authors conclude that, although bacteria may be present in soy beans, this is not invariably the case. *Urobacillus pasteurii* could not be isolated. The strong ureolytic action of the soy bean can not be attributed solely to bacteria, since sterile beans still possess a very strong urea-splitting power. A urease must, therefore, be present.

On account of the great variety of soy beans it is possible that some may not contain urease.

On the presence of urease in soy beans, J. T. GROLL (*Chem. Weekbl., 13 (1916), No. 10, pp. 254, 255*).—Experimental evidence demonstrating the presence of a urea-splitting enzym in the soy bean is submitted. The use of sterilized beans excluded the possibility of bacterial action on the urea. The results are contrary to those of Mom (see p. 112).

The preparation of anhydrous alcohol, L. W. WINKLER (*Ztschr. Angew. Chem., 29 (1916), No. 5, Aufsatzteil, p. 18*).—Commercial "absolute alcohol" contains about 1 per cent of water. To obtain perfectly anhydrous and ammonia-free alcohol the author proceeds as follows:

Metallic calcium shreds are thoroughly shaken on a sieve of medium mesh, by which process most of the adhering calcium nitrid is removed. To free the calcium from the oil it is thoroughly washed with carbon tetrachlorid and then dried in a stream of moisture-free carbon dioxid until the odor of carbon tetrachlorid is no longer perceptible. The alcohol is then distilled over the calcium prepared in this manner, using about 20 gm. of the metal to 1 liter of alcohol. To completely remove the ammonia from the anhydrous distillate it is treated with alizarin (several centigrams per liter) and in 10 cc. of this solution 0.5 gm. of tartaric acid is dissolved. This tartaric acid solution is added to the main distillate until there is a complete color change from reddish blue to pure yellow, when a slight excess of the acid solution is added and the alcohol finally distilled in a moisture-free atmosphere.

A simple cell for the determination of hydrogen ion concentration, J. H. LONG (*Jour. Amer. Chem. Soc., 38 (1916), No. 4, pp. 936–939, fig. 1*).—A simple and inexpensive apparatus is described in detail.

A comparative study of aeration and heat distillation in the Kjeldahl method for the determination of nitrogen, K. G. FALK and K. SUGIURA (*Jour. Amer. Chem. Soc., 38 (1916), No. 4, pp. 916–921*).—From their investigation the authors conclude that the aeration procedure in the ordinary Kjeldahl method very often gives inaccurate and unreliable results and is therefore not to be recommended for use.

A study of indicators for the determination of temporary hardness in water, J. F. NORTON and H. I. KNOWLES (*Jour. Amer. Chem. Soc., 38 (1916), No. 4, pp. 877–884*).—Experimental data submitted indicate that dimethylamidoazobenzene is the most satisfactory indicator for use in titrating bicarbonate alkalinity (temporary hardness) of natural waters. In the presence of alum lacmoid gives the best results but yields low results in the determination of bicarbonates. For low alkalinities the difference, however, is negligible.

The following standard is recommended: To 100 cc. distilled water 0.1 cc. of an alcoholic solution of dimethylamidoazobenzene is added (2:1,000, and 0.4 cc. normal sulphuric acid. The unknown solution containing the same amount of indicator is titrated until the color matches that of the standard.

Material for uniform laws regarding foodstuffs, IV–VI (*Entwürfe zu Festsetzungen über Lebensmittel. Berlin: Julius Springer, 1913, No. 4, pp. VIII+30; 1915, Nos. 5, pp. 33; 6, pp. 24; sups. to Ztschr. Untersuch. Nahr. u. Genussmtl., 26 (1913), No. 6; 29 (1915), Nos. 9 and 10*).—The first of these pamphlets describes the various kinds of cheese, together with their prescribed requirements, outlines analytical methods for the determination of water, ash,

fat, preservatives, and starch, and considers the interpretation of analytical results. The second pamphlet describes the various kinds of coffee, outlines the methods for the determination of extraneous material, water, ash, water-soluble extractives, caffein, artificial coloring matter, sugar and other carbohydrates, fat, crude fiber, protein, borax, and arsenic-containing shellacs, and considers the interpretation of the analytical results.

The various coffee substitutes are described in the third pamphlet and the prescribed requirements for such material outlined. Analytical methods for the determination of sugar, mineral oils, and glycerin are described, as well as some methods described in the pamphlet on coffee. The microscopical examination is also considered in some detail.

The determination of volatile oil in liqueurs, L. RONNET (*Ann. Falsif., 9 (1916), No. 87, pp. 14–16*).—The author outlines a method for the determination of the essence in a liqueur, based on the determination of the iodin value, and gives the procedure for calculating the amount of essence present from the iodin value obtained.

The determination of the volatile oils in liqueurs, C. F. MUTTELET (*Ann. Falsif., 9 (1916), No. 87, pp. 17–22; Ann. Chim. Analyt., 21 (1916), No. 3, pp. 50–55*).—A gravimetric method for the determination of volatile oils is described in detail.

Determination of the quantity of fat in cream, L. LINDET (*Ann. Sci. Agron., 4. ser., 4 (1915), No. 1–6, pp. 1–6*).—This material has been previously noted from another source (E. S. R., 34, p. 714).

Determination of stearic acid in butter fat, E. B. HOLLAND, J. C. REED, and J. P. BUCKLEY, JR. (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 3, pp. 101–113, figs. 2*).—A crystallization method devised at the Massachusetts Experiment Station is outlined as follows:

Five-tenths of a gram of melted insoluble acids is placed in an 8-oz. sterilizer bottle and 150 cc. of an alcohol-stearic-acid solution (3 gm. to 1,000 cc.), accurately measured with a pipette at 30° C., added. The bottle is sealed with a solid rubber stopper, shaken at a gradually increasing temperature until a clear solution is obtained, placed immediately in a pocket of the ice tank, and allowed to stand overnight. The following morning the solution is gently agitated by inverting the bottle several times, and in the afternoon it is siphoned off as thoroughly as possible by means of a small thistle tube and a perforated rubber stopper, using suction. The residue is dissolved in ethyl ether, transferred to a tared 140 cc. wide-mouth Erlenmeyer flask, the ether carefully distilled off, the residue dried at 100°, and weighed.

The construction of a constant-temperature tank, also devised by the authors and used for the crystallization of the stearic acid, is described in detail.

From the molecular weight determinations the crystalline precipitate obtained from butter fat was shown to be pure stearic acid and not a mixture. In studying the influence of various fatty acids on the precipitation of the stearic acid, lauric, myristic, and oleic acids, even in relatively large amounts, showed no appreciable effect. Palmitic acid, however, noticeably increased the solubility and affected the crystalline structure of the precipitate.

Analytical data obtained by the application of the proposed method to the determination of the stearic acid in the insoluble acid in butter fat and beef tallow are submitted in detail. The results indicate a higher percentage of stearic acid in the insoluble acids of butter fat than has been reported by earlier investigators. The concordant results obtained, however, and the close agreement of the molecular weight determinations of the crystalline product with the theoretical, indicate the identity and approximate purity of the stearic acid.

The determination of the iodin number of essential oils, R. MARCILLE (*Ann. Falsif., 9 (1916), No. 87, pp. 6–11, figs. 2*).—Experimental data as to the iodin numbers of various essential oils and oils used as adulterants, together with their refractive indexes, are submitted in tabular form. The effect of light on the iodin absorption was studied and the results are expressed graphically.

The iodin value of the oils in liqueurs can be determined without first distilling the alcohol, and is a valuable method for detecting adulteration in such products.

The detection and determination of benzoic acid in animal foodstuffs, K. BAUMANN and J. GROSSFELD (*Ztschr. Untersuch. Nahr. u. Genussmtl., 29 (1915), No. 10, pp. 397–409*).—After reviewing the methods commonly used for the detection and determination of benzoic acid the authors outline a procedure for which they claim excellent results. This method consists essentially of converting any free benzoic acid in the material to the alkali salt by treatment with dilute alkali, precipitation of the alkali soaps thus formed with calcium chlorid, precipitation of the protein with phosphotungstic acid, extraction of the benzoic acid from the clear filtrate, and, finally, determining the acid either colorimetrically or by titration with standard alkali. Carbon tetrachlorid was found to yield excellent results as an extraction agent.

Experimental data obtained from the application of the method to the determination of benzoic acid in milk, lard, butter, margarin, and cacao fat are submitted which indicate the accuracy of the method.

Critical observations on the qualitative and quantitative determination of saccharin and a new procedure for its qualitative determination, M. KLOSTERMANN and K. SCHOLTA (*Ztschr. Untersuch. Nahr. u. Genussmtl., 31 (1916), No. 3, pp. 67–78*).—Earlier methods used for the determination of saccharin are briefly reviewed. A proposed procedure is described in detail and the theory of the reaction discussed. The reaction is sensitive to 1 mg. of saccharin and is more specific than the others commonly used.

The quantitative determination of urea, C. P. MOM (*Chem. Weekbl., 13 (1916), No. 3, pp. 72–75*).—A method for the determination of urea in urine, using *Urobacillus pasteurii*, is described. The urea-splitting power of the soy bean is not attributed to the presence of a urease, but rather to bacterial action.

The chemical composition and evaluation of lime-sulphur solutions, J. BODNÁR (*Chem. Ztg., 39 (1915), No. 114, pp. 715, 716*).—The author contends that lime-sulphur solutions contain no soluble sulphite and that the use of the term "sulphite+sulphate" in the evaluation of such solutions is incorrect and should be replaced by the word "sulphate." Experimental data are submitted in support of this contention.

A new procedure for the evaluation, based on the following equations, is described:

$$CaS_4+2AgNO_3=Ag_2S+S_3+Ca(NO_3)_2$$
$$CaS_5+2AgNO_3=Ag_2S+S_4+Ca(NO_3)_2$$
$$CaS_2O_3+2AgNO_3=Ag_2S_2O_3+Ca(NO_3)_2$$
$$Ag_2S_2O_3+H_2O=Ag_2S+H_2SO_4$$

Briefly the procedure consists of diluting 10 cc. of the original solution to 100 cc. and designating this as solution *A*. To 50 cc. of tenth-normal silver nitrate diluted to 70 cc. 10 cc. of solution *A* is added, with constant agitation which facilitates the clumping of the precipitate and produces a clear supernatant liquid. After diluting the mixture to 100 cc. it is filtered by suction through a Gooch crucible into a dry suction flask. The precipitate is thoroughly

washed, dried for an hour and a half in a steam drying oven, and weighed as silver sulphid. The sulphuric acid and excess silver nitrate are then determined in an aliquot of the filtrate by adding from 20 to 30 cc. tenth-normal sodium chlorid and from 10 to 15 cc. tenth-normal sodium hydroxid, together with a few drops of phenolphthalein, and titrating with tenth-normal sulphuric acid to the neutral point. To the same solution a few drops of potassium chromate are added, and the excess of sodium chlorid titrated with tenth-normal silver nitrate.

For calculating the various forms of sulphur the following formulas are proposed:

Thiosulphate sulphur: $t=100\times4(a-b).0.0016035=0.6414.(a-b)$;

Sulphid sulphur: $s=100\times2(25+c-d).0.0016035-t/2=0.3207(25+c-d)-t/2$; a=cc. tenth-normal NaOH; b=cc. tenth-normal H_2SO_4; c=cc. tenth-normal $AgNO_3$ used in titrating the excess of NaCl; d=cc. tenth-normal NaCl; t=thiosulphate sulphur; s=sulphid sulphur.

From the weight of silver sulphid (e) the polysulphid sulphur (p) is calculated as follows:

$$Ag_2S=7.727.(s+t/2)\ ;\ p=100e-7.727.(s+t/2)$$

From these figures the amounts of tetra- and pentasulphid present can be calculated.

The results of several analyses carried out according to the proposed procedure are submitted.

Jellies and marmalades from citrus fruits, W. V. CRUESS (*California Sta. Circ. 146 (1916), pp. 8, figs. 2*).—This circular discusses the preparation of jellies and marmalades from citrus fruits. Because of their richness in pectin the citrus fruits are especially suitable for this purpose, either to be used alone or blended with other fruits which are poor in pectin.

A thermometer and also a hydrometer test for determining the sugar concentration in the jelly sirup is described. Either of these tests is deemed far more reliable than the usual "sheeting" test.

Recipes for preparing the jellies and marmalades are included.

The distillation of apple cider in sugar-beet distilleries, E. SAILLARD (*Monit. Sci., 5. ser., 6 (1916), I, No. 890, pp. 25–29*).—This reports the progress of an investigation carried on with apple and beet products as possible sources of alcohol, which was ordered by the Minister of Agriculture in France.

The present situation of the question on the rôle of bacteria in voluntary decrease of acidity in wines, A. M. KRUPENIKOV (*Trudy Selsk. Khoz. Bakt. Lab., 5 (1914), pt. 2, pp. 195–220*).—In the viticultural regions of Bessarabia, the Don, the Rhine, and the Moselle the grapes are not always fully ripe when used for making wine. Such wines contain large amounts of acid. Artificial means are used to diminish this acidity, such as the addition of water or calcium and potassium carbonates for the neutralization of the acids. This procedure, however, injures the wine.

To obviate this, experiments were made with various bacteria to determine their effect on reducing the acidity of the wine. The results showed that to decrease the acidity it is necessary to promote a very rapid fermentation with pure cultures of yeast by increasing the temperature of the cellar. The wine should be kept in contact as long as possible with the yeast, although the first transfusion should not be delayed so long as to injure the wine. The temperature after this operation should not be below 15° C. (59° F.). The residue should be thoroughly mixed so that the bacteria come in direct contact with the wine. The wine should be transfused into uncovered or only slightly covered barrels, allowing some of the residue to mix with the wine.

If it is desired to maintain the acidity of the wine the decrease can be checked by lowering the temperature or by fumigation.

It is indicated that this method of decreasing the acidity of wines by means of pure cultures of yeast bacteria is still in its infancy, and it is hoped that other bacteria will be found which can resist larger amounts of alcohol and acids than those used at present, viz, *Saccharomyces apiculatus*, *S. ellipsoideus*, and *Bacillus gracilis*.

A handbook for cane-sugar manufacturers and their chemists, G. L. SPENCER (*New York: John Wiley & Sons, Inc., 1916, 5. ed., rev. and enl., pp. XV+529, pl. 1, figs. 93*).—This is the fifth edition, partly rewritten and enlarged, of this well-known handbook. The section devoted to manufacture has been greatly enlarged, and the processes in use in the manufacture of raw, plantation white, and refined sugars are described in detail. Methods for the analysis of sugar and the chemical control of the factory are given, together with procedures for the examination of various materials used in the process of manufacture. Many tables of value to sugar chemists and also of general interest are included.

Osage orange waste as a substitute for fustic dyewood, F. W. KRESSMANN (*U. S. Dept. Agr. Yearbook 1915, pp. 201–204*).—The dyestuff obtained from Osage orange waste has been found, by actual trial in the tannery, to be of value in dyeing leather, as it gives the same shades and depth of color as fustic.

Its application to cotton dyeing has not been fully demonstrated, although it is indicated that it could probably be used for the cheaper grades of twines and cords.

See also a previous note (E. S. R., 32, p. 613).

Ground-wood pulp, J. H. THICKENS and G. C. MCNAUGHTON (*U. S. Dept. Agr. Bul. 343 (1916), pp. 151, pls. 12, figs. 44*).—This bulletin reports the results of tests on (1) the grinding of cooked and uncooked spruce and (2) substitutes for spruce in the manufacture of ground-wood pulp.

Complete data obtained from the tests are submitted in tabular form, and to some extent discussed. Samples of the paper made from the 25 different woods used, some of which were used in actual printing tests, are also submitted.

METEOROLOGY.

Agricultural meteorology, J. W. SMITH (*U. S. Mo. Weather Rev., 44 (1916), No. 2, pp. 74, 75*).—This article, which is an abstract of a paper presented at the Second Pan American Scientific Congress (E. S. R., 34, p. 308), defines agricultural meteorology, refers briefly to work along this line by the Weather Bureau and reports investigations by the author in the study of critical periods of farm crops in Ohio, especially by means of the curve chart and the dot chart as well as by calculation of the correlation coefficient. The crops included in the study were corn, potatoes, and winter wheat and the periods covered between 50 and 60 years.

It was found that the most important weather factor for both corn and potatoes is rainfall and the critical month July. Temperature was found to be the most important weather factor in the case of winter wheat and the critical month March. The critical rainfall for July in the case of corn is 3 in. It appears that July must be wet and moderately warm for the best crop of corn, but cool and moderately wet for the best growth of potatoes. The most important 10-day period for corn was found to be that immediately following blossoming when the weather must be wet and moderately cool. For potatoes the 10 days following blossoming must be cool and moderately wet. The most

critical 10-day period for corn is from August 1 to 10 and for potatoes from July 1 to 10. The dominant weather factor for winter wheat was found to be more difficult to determine than for the other crops. Contrary to the popular belief, it was found that there was no benefit to winter wheat from a snow covering or damage from lack of it. A snowfall in January appeared to be favorable, but, contrary to the usual opinion, snowfall in March was decidedly detrimental to winter wheat.

In the author's opinion "one of the first developments of agricultural meteorology should be to find the critical period in the growth of the various staple crops in different sections of the country."

Stories of the atmosphere, R. NUNN (*U. S. Dept. Agr. Yearbook 1915, pp. 317–327, pl. 1, figs. 4*).—It is stated that the object of this article is to suggest "titles and give glimpses into a few of the many stories that are available to those who desire to read them, either in books or in the air itself." It gives a very brief general account of the atmosphere and its circulation; points out some of the difficulties of studying the subject; calls attention to some interesting facts regarding atmospheric dust and moisture; sets forth the general plan and purpose of weather maps and what they show; and urges the importance of a more general study of the weather by reading and observation.

Dry fogs and their classification, G. G. SHENBERG (*Trudy. Selsk. Khoz. Met., No. 15 (1915), pp. 162, figs. 5*).—Fog is defined as a haziness of the lower atmosphere decreasing its transparency. Fogs are divided into two classes, (1) damp fogs in which the decreased transparency of the atmosphere is due to minute drops of water or ice crystals and (2) dry fogs caused by scarcely perceptible particles of earth, dust, smoke, ashes, etc. Smoke fogs, ash fogs, dust fogs, optical fogs, and cosmic fogs are described in detail and a classification is proposed.

Monthly Weather Review (*U. S. Mo. Weather Rev., 44 (1916), Nos. 1, pp. 1–60+XVII, pls. 11, figs. 6; 2, pp. 61–110, pls. 14, figs. 11*).—In addition to weather forecasts, river and flood observations, and seismological reports for January and February, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during January and February, 1916; condensed climatological summaries; the usual climatological tables and charts; and a subject and author index for 1915, these numbers contain the following articles:

No. 1.—Solar Radiation Measurements at Lincoln, Nebr., 1911–1915, by H. H. Kimball; Solar Radiation Measurements at Madison, Wis., 1913–1915, by H. H. Kimball and E. R. Miller; Duration of Twilight (reprinted), by H. H. Kimball; Lunar Halo of July 24, 1861 (illus.), by W. B. Frew; Wind Velocity and Elevation (illus.), by W. J. Humphreys; Some Researches in the Far Eastern Seasonal Correlations (illus.), by T. Okada; Annual Hours of Fog, 1885–1915; an abstract of The Physician and the Weather Bureau (illus.), by F. A. Carpenter (E. S. R., 34, p. 509); and Alto-cumulus with Virgulus, by C. F. Talman.

No. 2.—Meteor Observations; Arequipa Pyrheliometry; Horizontal Rainbows on Lake Mendota (illus.), by C. Juday; Halos at Fort Worth, Tex., and Their Relation to the Subsequent Occurrence of Precipitation, by H. H. Martin; Origin and Maintenance of the Earth's Electric Charge, by W. F. G. Swann; Meteorology of the Moon (illus.), by W. H. Pickering; Agricultural Meteorology, by J. W. Smith (see p. 114); Breathing Wells and Pressure Changes; Alto-cumulus with Virgulus; Severe Ice Storm in Michigan; Relation Between Rainfall and Synoptic Winds, by H. H. Clayton; Long-range Forecast of the Winter Minimum Temperature for Hamada, Japan, by M.

Isida; Cirrus Directions at Melbourne and Storms Affecting Victoria, by E. T. Quayle; and Relation of Precipitation to Stream Flow in Montana (illus.), by R. F. Young.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 2 (1915), No. 13, pp. 404, pls. 2, figs. 47*).—This is a summary of climatological data of each State for the year 1915. The data are tabulated in detail and the principal weather conditions are summarized for each month and for the year.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 3 (1916), Nos. 1, pp. 236, pls. 2, figs. 6; 2, pp. 236, pls. 2, figs. 6*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1916, respectively.

Rainfall data of Berkeley, California, W. G. REED (*Univ. Cal. Pubs., Engin., 1 (1915), No. 5, pp. 69–81*).—Data for amount, frequency, and intensity of rainfall at Berkeley, Cal., are summarized for the period from 1887 to 1915.

Rainfall data of Berkeley, California, II, W. G. REED and M. K. WHITE (*Univ. Cal. Pubs., Engin., 1 (1916), No. 6, pp. 83–116, pl. 1, fig. 1*).—Supplementing the above report on rainfall observations, this paper summarizes incomplete data obtained from a recording rain gage maintained by the department of civil engineering of the university since 1911 for the purpose of studying the water supply of the university. The data are discussed with special reference to the frequency and intensity of the rainfall.

It is shown that the maximum intensity for the place and period of observations was at the rate of 3.5 in. per hour for 5 minutes and 0.5 in. per hour for 60 minutes. "A statistical and graphic study was made of all 12-hour periods for which intensity records are available. From this study the following indications have appeared: (1) When 0.8 in. falls in 12 hours there is a chance that the maximum rate for 1 hour exceeds 0.5 in.; (2) when 0.8 in. falls in 12 hours it is probable that 0.3 in. in 1 hour has been exceeded; this rate is half the maximum shown by the Grunsky curve and has been assumed as the lower limit of intensity of practical importance; (3) when 0.8 in. falls in 12 hours there is a chance that 0.15 in. in 5 minutes has been exceeded; this is the maximum given by the Grunsky curve for 5 minutes; (4) when 0.8 in. falls in 12 hours it is probable that 0.07 in. in 5 minutes has been exceeded; this has been assumed as the lower limit of intensity of practical importance; it is half the maximum given by the Grunsky curve."

California earthquakes during 1915, A. H. PALMER (*Bul. Seismol. Soc. Amer., 6 (1916), No. 1, pp. 8–25, figs. 4*).—A complete record is given.

Meteorological observations in Panama (*Bol. Estad. Panama, No. 26 (1915), pp. 2–7*).—Observations on pressure, temperature, humidity, precipitation, cloudiness, and winds during 1913 are summarized in tables.

Annual report of the weather bureau, 1914 (*U. S. Dept. Int., Ann. Rpt. Weather Bur. [Philippine Islands], 1914, pts. 1 and 2, pp. 140*).—Part 1 of this report contains brief statements regarding the stations, personnel, and work of the Philippine Weather Bureau. Part 2 gives tabular summaries of observations at the Central Observatory of Manila during 1914 on pressure, temperature, relative humidity, vapor pressure, clouds, and direction, velocity, and frequency of winds.

Is rainfall decreasing? (*Agr. Gaz. N. S. Wales, 27 (1916), No. 4, p. 246*).—The average rainfall of twelve towns in New South Wales by 10-year periods from 1856–1915 is tabulated and compared with the average for the whole period. The data are considered too limited to permit of definite conclusions,

but attention is called to the fact "that the averages for the period 1886–1895 are almost invariably higher than those of any previous or succeeding period, and considerably above those of the average to date, while those for the period 1906–1915 are lower than any of the preceding ones."

SOILS—FERTILIZERS.

Soil survey of the Merced area, California, E. B. Watson et al. (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 70, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station and issued April 20, 1916, deals with the soils of an area of 614,400 acres, including nearly all of Merced County, California, and located nearly midway between the northern and southern ends of the San Joaquin Valley. The topography ranges from that of the foothills proper to flat. "The soils of the area fall naturally into four groups, (1) residual soils, (2) soils derived from old valley-filling material, (3) soils derived from recent alluvium and later valley-filling material, and (4) miscellaneous material." Forty-five soil types of 14 series are mapped of which the Madera series and the Fresno series are the most extensive.

Soil survey of Warren County, Indiana, E. J. Grimes and E. H. Stevens (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 39, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology and issued April 12, 1916, deals with the soils of an area of 235,520 acres in western Indiana, the topography of which varies from level to undulating and broken, and in which "all the formerly water-logged areas of the prairie have been reclaimed by artificial drainage. . . .

"The soils of Warren County are derived largely from the unconsolidated deposits of the early Wisconsin glaciation." Including meadow, muck, gravel pits, and steep broken land, 15 soil types of 7 series are mapped, of which the Carrington and Miami silt loams and the Clyde silty clay loam cover, respectively, 37.4, 29.7, and 18.8 per cent of the area.

Soil survey of Muscatine County, Iowa, H. W. Hawker and H. W. Johnson (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 64, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station and issued April 10, 1916, deals with the soils of an area of 276,480 acres in southeastern Iowa which lies in the glacial and loessial and river flood plain soil provinces. The topography is mainly level to gently rolling, with some hills and ridges.

The soils of the county are of glacial origin. Including marsh, muck, meadow, and river wash, 28 soil types of 9 series are mapped, of which the Muscatine, Memphis, and Buckner silt loams cover, respectively, 37.2, 19.7, and 7.5 per cent of the area.

Soil survey of Seward County, Nebraska, A. H. Meyer, E. H. Smies, L. T. Skinner, and W. A. Rockie (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 40, fig. 1, map 1*).—This survey, made in cooperation with the Nebraska Soil Survey and issued April 25, 1916, deals with the soils of an area of 367,360 acres in southeastern Nebraska, the topography of which varies from flat to hilly and deeply dissected. "The streams are few, and there are sections in the county which are not tapped by any drainage way. Drainage is quite well developed, except on the broad divides in the western part of the county."

The soils are classified as upland, terrace, and first bottom soils. Eleven soil types of 7 series are mapped of which the Grundy silt loam covers 61.5 and the Wabash silt loam 12.3 per cent of the area.

Soil survey of Thurston County, Nebraska, A. H. MEYER, M. W. BECK, and W. A. ROCKIE (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 44, fig. 1, map 1*).—This survey, made in cooperation with the Nebraska Soil Survey and issued April 22, 1916, deals with the soils of an area of 247,680 acres in northeastern Nebraska, the topography of which ranges from almost flat through rolling and steeply rolling to hilly and extremely dissected. As a whole, the county is said to be well drained.

The soils are upland terrace and first bottom soils. "There is considerable range in texture, from clay through silt loam, loam, sandy loam, and very fine sandy loam to sand." Including riverwash, 15 soil types of 9 series are mapped of which the Marshall and Wabash silt loams cover respectively 62.8 and 16.5 per cent of the area.

Soil survey of Florence County, South Carolina, J. H. AGEE, J. A. KERR, and W. E. MCLENDON (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 36, fig. 1, map 1*).—This survey, issued April 17, 1916, deals with the soils of an area of 480,640 acres in east-central South Carolina lying wholly within the Coastal Plain province. The topography is level to very gently sloping.

The soils of the county are of old sedimentary and old and recent alluvial origin, "are predominantly sandy, and include coarse sands, coarse sandy loams, sands, sandy loams, fine sands, fine sandy loams, and very fine sandy loams. . . . The high and sloping sandy soils are well drained, while the low-lying soils and those having an impervious clay subsoil . . . have very poor or imperfect drainage." Including sandhill and swamp, 33 soil types of 10 series are mapped of which the Norfolk sandy loam and fine sandy loam, the Coxville sandy loam, and swamp soils cover, respectively, 14.6, 9.3, 8.5, and 13.3 per cent of the area.

Soil survey of McDowell and Wyoming counties, West Virginia, W. J. LATIMER (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 32, fig. 1, map 1*).—This survey, made in cooperation with the West Virginia Geological Survey and issued April 14, 1916, deals with the soils of an area of 669,440 acres comprising two counties in southern West Virginia which lie within the Allegheny Plateau and consist of a region thoroughly dissected by a series of widely branching streams which reach every part of their area. The surface is broken and mountainous and comprises a series of irregular ridges and deep, narrow valleys.

The soils of the area are of residual and old and recent alluvial origin. Including rough stony land, 12 soil types of 5 series are mapped, of which the Dekalb stony silt loam and silt loam covers 72.1 and 16.2 per cent of the area, respectively.

Analyses of Nova Scotian soils, L. C. HARLOW (*Proc. and Trans. Nova Scotian Inst. Sci., 13 (1913–14), No. 4, pp. 332–346*).—Analyses of 86 samples of Nova Scotian soils are reported and discussed. The results are taken to indicate (1) that the soils "have a good supply of potash, but that it is only slightly available, (2) that phosphoric acid in many soils is in small amounts, is about one-third available, and hence soon used, (3) that, while volatile matter is quite high, it is deficient in nitrogen, and (4) that lime is very deficient in many soils. . . . The great problem in Nova Scotia seems to be to increase and maintain the amount of available nitrogen."

Relations between the total phosphoric acid content and the water- and citrate-soluble phosphoric acid in some soils of central Peru, A. HUTIN (*Ann. Chim. Analyt., 20 (1915), No. 2, p. 31; abs. in Chem. Abs., 9 (1915), No. 13, p. 1816*).—Analyses of six soils and their subsoils, selected from a large number

of analyses of soils from farms in central Peru, are reported, which show that while the total phosphoric acid content is higher in the soil than in the subsoil, the ratio of water- and citrate-soluble phosphoric acid to total phosphoric acid is very nearly the same for both soil and subsoil. In most cases about from 39 to 53 per cent of the total phosphoric acid of the soil was water- or citrate-soluble.

Soil investigations on the red beech litter experimental plats in the forest district of Philippsburg, K. GANTER (*Forstw. Centbl., n. ser., 37 (1915), Nos. 7, pp. 312–335; 8–9, pp. 392–407, pls. 3; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1578, 1579*).—Investigations on the physical and chemical properties of the soils of plats receiving the leaves and litter of beeches for a number of years are reported. Some of the plats were raked over annually, some once in five years, and some were left unraked. The unraked soil consisted of a layer of leaves and mold from 5 to 7 cm. (1.97 to 2.8 in.) thick, underlaid by 10 cm. of humus sand, and 70 cm. of gray sand. The soils raked every five years had a leaf and mold covering from 2 to 3 cm. thick, while the layer of humus sand was from 5 to 7 cm. in thickness.

It was found that the unraked soils showed the greatest total water content and the least evaporation, while the soils raked annually showed a medium water content and a high evaporation. Soils raked every five years had the smallest moisture content and an evaporation about equal to that of the unraked soils. The soils raked annually showed the greatest content and the soils raked every five years the smallest content of matter which could be washed out with water. The unraked soils were about equal in this respect to the soils raked every five years. These two types also showed the greatest porosity. The annually raked soils showed the highest, the soils raked every five years a medium, and the unraked soils the lowest, temperature. The unraked soils showed the greatest humus and nitrogen content and the greatest average increase in tree growth, followed in order by the soils raked every five years and the annually raked soils.

Contribution to the study of the soils of the east coast [of Madagascar], G. CARLE and GOHIER (*Bul. Econ. Gouvt. Gén. Madagascar, 15 (1915), I, No. 1, pp. 35–41*).—Chemical analyses of 49 samples of hill, plateau, and swamp soils and subsoils from the east coast of Madagascar are reported and discussed.

The hill soils are generally residual clays and are considered to be relatively deficient in phosphoric acid and to be generally unproductive. The plateau or alluvial soils are considered to be well supplied with nitrogen, phosphoric acid, and potash, but to be constantly deficient in lime. The swamp soils are well supplied with nitrogen, but are considered to be relatively deficient in phosphoric acid and lime. Proper drainage is said to be one of the most important factors in increasing the productiveness of the swamp soils.

The predominating minerals in Dutch East Indian soils, E. C. J. MOHR (*Dept. Landb. Nijv. en Handel [Dutch East Indies], Meded. Lab. Agrogeol. en Grondonderz., No. 2 (1915), pp. 11*).—This is a brief classified presentation of the mineralogy of these soils.

Soils and their treatment, W. J. SPAFFORD (*Jour. Dept. Agr. So. Aust., 19 (1915), No. 3, pp. 267–278*).—This is an address before the Nantawarra Branch of the Agricultural Bureau of South Australia, in which the origin, physical, mechanical, and chemical properties of soils are briefly dealt with, special reference being made to the soils of the district.

The decomposition of clay marl, C. CIRIELLI (*Bol. Min. Agr., Indus. e Com. [Rome], Ser. B, 14 (1915), I, No. 3–4, pp. 91, 92*).—Tests of the effect of pro-

gressive heating of clay marl from 700 to 800° C. in an electric furnace led to the conclusions that the water of hydration is completely eliminated by heating to a temperature of 700°, and that the decomposition of carbonates and the elimination of carbon dioxid takes place rapidly at 800°. It was also found that the density tended to increase with progressive heating beyond 800°.

Improving acid soils, A. W. Blair (*New Jersey Stas. Circ. 54 (1916), pp. 3–11, pls. 4*).—This is a popular discussion of soil acidity and its causes, and its correction by the use of calcium carbonate, burned lime, hydrated lime, ground oyster shells, burned oyster-shell lime, unleached hardwood ashes, and basic slag. It is estimated that about four-fifths of the farm lands of New Jersey now under cultivation are acid to an extent that materially decreases crop yields.

Investigations of soil air on upland moors, A. Densch (*Mitt. Ver. Förd. Moorkultur Deut. Reiche, 33 (1915), Nos. 21, pp. 407–413; 22, pp. 423–428*).—Investigations on the amount and composition of the soil gases of upland moors are reported. The soil samples were taken at depths of from 16 to 20 cm. (6.3 to 7.9 in.).

It was found that the absolute content of gas in upland moor soils, even with a high water content, was not less than that of mineral soils. The processes of oxidation and decomposition in cultivated upland moor soils in no case produced a large enough increase in carbon dioxid or decrease in oxygen content of the soil gas to influence plant growth unfavorably. Cultivated upland moor soil had almost identically the same oxygen and carbon dioxid contents as mineral soils. The composition of the gases of upland moor meadow soils corresponded approximately to that of lowland moor meadow soils.

Soluble nonprotein nitrogen of soil, R. S. Potter and R. S. Snyder (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 2, pp. 61–64*).—Analyses made at the Iowa Experiment Station of 5-gm. portions of silt loam soil, containing 0.3 per cent nitrogen, for alkali-soluble and soluble nonprotein nitrogen are reported.

"The general procedure followed was to determine the nitrogen in the alkali extract of soil with and without added material and the determination of nitrogen in the filtrate from the precipitate of the proteins in the alkali extract of soil with and without added material." The substances added "were chosen to represent classes of compounds which conceivably might be in soils." It was concluded that "if the results with the pure proteins be considered, it is probable that the alkali extract as a whole contains no definite group of compounds. From the results obtained by the precipitation of the alkali extract with trichloracetic acid it would seem that the soluble nonprotein fraction may contain most of the simpler nitrogenous compounds, and therefore its determination would give an index of the degree of decomposition of the organic matter in the soil."

The nature of humic acid, S. Odén (*Ark. Kemi, Min. och Geol., 5 (1913–1915), No. 3–5, Art. 15, pp. 13; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 5, pp. 660, 661; Chem. Zentbl., 1915, I, No. 26, p. 1385*).—Studies along the lines of work previously noted (E. S. R., 32, p. 813) with so-called black peat, dried sphagnum moss, and forest humus are reported, in which the electrical conductivity of a dilute ammonia solution, with and without the extract from the three types of organic matter, was observed.

Adsorption of ammonia was found to take place in the case of the extracts from all three samples of organic matter. At the same time considerable salt formation occurred in two cases where the dark humus was abundant, but not in the case of the dried sphagnum moss extract. These results are taken to indicate that one or more acids must exist in humus.

On the relative numbers of rhizopods and flagellates in the fauna of soils, C. A. KOFOID (*Science, n. ser., 42 (1915), No. 1096, pp. 937–940, fig. 1*).—This is a brief review of various investigations on the subject by others showing the differences in results obtained. A list of references to literature bearing on the subject is given.

Soil sampling for bacteriological analysis, H. A. NOYES (*Jour. Amer. Soc. Agron., 7 (1915), No. 5, pp. 239–249, pl. 1, fig. 1*).—A method of sampling soil for bacteriological analysis, as described in the article previously noted (E. S. R., 34, p. 513), is presented, and comparative tests of this method with the soil auger method, the Iowa Station method (E. S. R., 27, p. 720), and the slice method are reported. These tests were conducted at the Indiana Experiment Station.

Fertilizer situation in the United States, D. F. HOUSTON (*U. S. Senate, 64. Cong., 1. Sess., Doc. 262 (1916), pp. 6*).—This is a report from the Secretary of Agriculture in response to Senate Resolution 65, in which the fertilizer situation in the United States is briefly reviewed, with special reference to the shortage of potash and the high price of sulphuric acid needed for the manufacture of acid phosphate. The possible means of relieving the situation suggested are the production of potash from the alunite deposits of Utah and neighboring States and from the giant kelp beds of the Pacific coast, and the utilization of hydroelectric power for the production of soluble phosphates and of industrial wastes as nitrogenous fertilizers. Work of the Bureau of Soils on the utilization of kelp as a fertilizer and on electrical methods of producing soluble phosphates and synthetic nitrogen compounds is briefly referred to.

Mineral resources of the United States for 1914.—I, Mineral production of the United States in 1914, H. D. MCCASKEY (*U. S. Geol. Survey, Mineral Resources of the United States Calendar Year 1914, pt. 1, pp. *1–*69, pl. 1, fig. 1*).—This is a detailed summary of mineral production of the United States in 1914.

"The marketed production of phosphate rock in 1914 amounted to 2,734,043 long tons, valued at $9,608,041, compared with 3,111,221 long tons, valued at $11,796,231, in 1913; 2,973,332 long tons, valued at $11,675,774, in 1912; 3,053,279 long tons, valued at $11,900,693, in 1911; and 2,654,988 long tons, valued at $10,917,000, in 1910. The quantity of phosphate rock reported as mined during 1914 was 2,649,174 long tons, against 3,152,208 long tons mined in 1913. The imports of crude phosphates, guano, kainit, manure salts, etc., for consumption were valued at $9,921,439 in 1914, $10,819,253 in 1913, and $8,893,090 in 1912. The exports of phosphate rock in 1914 were 964,114 long tons, valued at $6,771,652, against 1,366,508 long tons, valued at $9,996,580, in 1913; and 1,206,520 long tons, valued at $8,996,456, in 1912. There was no actual production of potash salts in the United States in 1914. The imports of potash salts (not including kainit and manure salts) for consumption were valued at $8,743,973 in 1914, against $10,805,720 in 1913."

Determination of the most convenient formula for the use of chemical fertilizers in agriculture, I. M. CONCHA (In *Primera Semana Social Agricola. Santiago de Chile: Universidad Católica de Santiago, 1914 pp. 3–14*).—The important factors involved in the determination of the fertilizer requirements of a soil are pointed out as the law of minimum, the composition of the soil, and the amounts of fertilizing constituents extracted from the soil by average crops. The value of field tests with crops is also noted.

Soil experiment fields.—A progress report, G. ROBERTS (*Kentucky Sta. Bul. 199 (1916), pp. 43–93, figs. 12*).—This is a progress report of studies at several

experimental farms in Kentucky, each of which is typical of a more or less extensive area of farming lands, on the fertilizer and manurial requirements of the soil and on crop rotations and adaptations.

Burnside Field, Pulaski County.—On a limestone soil, deficient in organic matter and nitrogen, growing corn, oats, clover, soy beans, and wheat, it was found "that no improvement was made in the absence of phosphates, and there was very little increase in yields due to potash. . . . On this soil acid phosphate is more effective, dollar for dollar, than rock phosphate. . . . The best yield of clover was made on the rock phosphate plat."

London Field, Laurel County.—On a moderately acid silt loam soil, with minimum potash content, growing a 4-year rotation of corn, cowpeas or soy beans, wheat, and clover, it was found that limestone and acid phosphate were highly beneficial, the most profitable treatment being a combination of the two. Potash used alone and with limestone and acid phosphate did not increase the yields, but gave profitable results when used only with acid phosphate. The results are taken to justify "the recommendation of the use of potash on the soils of this region when lime can not be used, especially on the more sandy soils."

Lexington Field, Fayette County.—Experiments on a slightly acid soil typical of the Trenton limestone region on which was practiced a rotation of corn, soy beans, wheat, and clover showed no consistent or decided effect from any of the fertilizing constituents (acid phosphate, potassium sulphate, or limestone) applied. It is considered safe to conclude that "the use of phosphates and potash is not necessary on the well-drained, highly phosphatic soils of the Trenton limestone formation when organic matter is maintained in quantities to furnish the necessary nitrogen for good crop yields."

Berea Field, Madison County.—Experiments on a strongly acid silt loam soil supporting a rotation of corn, soy beans, wheat, and clover, with cowpeas as a catch crop, led to the conclusion that "limestone and phosphates have shown decided results. Limestone is probably the first requirement of this soil and phosphate next. The best results were obtained by using both together."

Greenville Field, Muhlenberg County.—Experiments on a moderately acid silt loam soil, typical of the uplands of the Western Coal Field, on which two rotations were practiced, showed, with the rotation of corn, soy beans, wheat, and clover, with cowpeas as a catch crop and rye as a winter cover crop, "the need for the combination of limestone and phosphates in the improvement of these soils. . . . Potash has given good increases in some cases. . . . Wherever phosphates were used good yields of clover were obtained, whether any other material was used or not." With the tobacco, potatoes, and clover rotation no material increase was observed with any treatment which omitted phosphorus. Potash gave only slight increases. Limestone did not injure the potatoes and nitrogen was profitably used on tobacco and potatoes.

Russelville Field, Logan County.—Experiments with a slightly acid silt loam soil typical of the St. Louis limestone formation and supporting a rotation of corn, soy beans, wheat, clover, and timothy gave results which are taken to justify the conclusion "that limestone and phosphates may be used with profit on such soils, especially when used together. The effect of phosphates is especially apparent on wheat and clover. The effect of limestone is especially noticeable on the corn crop of 1915, as is also the case on the clover crop sown in 1915. Potash has produced considerable increases on the 1915 corn crop in some cases."

Lone Oak Field, McCracken County.—Experiments on a moderately acid silt loam soil typical of the uplands of the original wooded area of the Jackson Purchase and supporting a rotation of corn, soy beans, wheat, clover, and timothy with crimson clover or rye as a winter cover crop, gave inconclusive results. However, it is considered safe to recommend the use of limestone and phosphate on this soil, preferably together.

Mayfield Field, Graves County.—Experiments on a moderately acid yellow silt loam, typical of the untimbered land of the Purchase Region and on which a rotation of corn, oats, wheat, clover, and timothy was practiced, showed that "limestone and phosphates used together are giving decided increases. The effect of limestone and phosphates is very pronounced on the clover sown in the spring of 1915. In some cases potash has given good increases and in some it has not. . . . Nitrate of soda has given a profitable increase on one oats crop and on one wheat crop. . . . It is safe to say that nitrate of soda should not be used as a top-dressing on wheat in this region unless the ground is either fairly fertile or has been treated with phosphate."

Green manuring in the Central Provinces, R. G. ALLAN (*Agr. Jour. India, 10 (1915), No. 4, pp. 380–394, pls. 2*).—A review of experience with green manuring before wheat in the Central Provinces of India, using as green manures Sesbania, *Crotalaria juncea, Cassia occidentalis, Psoralea corylifolia, Dolichos uniflorus*, and *Vernonia cinerea*, is given.

The results are taken to indicate that in similar climates "earliness of inversion is more important than quantity. The material should be in by the first week of August. It is desirable to sow with the first rains and to use either a quick crop like *C. juncea* or to collect weeds and apply. . . . Success is not likely unless at least 12 in., or better, 16 in., of rain is received after plowing in, while below 9 or 10 in. the results are not safe and the process is definitely inadvisable. The condition under which plowing is done must be kept in mind in judging the results and the effect of getting on the land at the wrong time allowed for, if necessary.

"When irrigation is available, either earlier sowing of the green crop is advisable, or, if the natural precipitation falls below the minmum of 9 in., the use of water to supplement the natural precipitation in rotting the green manure. Such irrigation must be applied before, not after, sowing the wheat.

"In areas where a rainfall of 12 in. after the first of August can not be relied on, some increased fertility can be gained by the growth of a legume and its use for fodder in the monsoon. In this case it is desirable to invert the stubble by mid-August so as to allow of consolidation by the later rains before sowing wheat. . . . In areas with a rainfall of less than 35 in. of ordinary monsoon distribution, green manuring for a wheat crop is practically out of the question."

Investigations relative to the use of nitrogenous plant foods, 1898–1912, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Bul. 288 (1916), pp. 3–126, figs. 11*).—This bulletin reports a continuation up until 1912 of the experiments described in a previous note (E. S. R., 21, p. 529) and summarizes the results of the 15 years' experiments.

It was found that the yield of dry matter and the percentage of nitrogen recovered in the crop were greatest with sodium nitrate, followed in order by ammonium sulphate and dried blood. "Of the various grades of manure used the solid and liquid stood highest in yield of dry matter and the solid, leached, stood higher than the solid, fresh. The highest average yield of dry matter and nitrogen from the main crops, third rotation, was where solid and liquid manure, fresh, was used in conjunction with the 10-gm. portion of nitrate of soda. The second highest yield was where solid and liquid manure, leached,

was used in conjunction with the 10-gm. portion of nitrate. In average yield of nitrogen for all series, the yield of the third rotation stands between the yields of the first and second rotations. The highest percentage of nitrogen recovered, third rotation, was with nitrate of soda alone. Next in order stood the cylinders on which solid and liquid manure, fresh, was used in conjunction with the 10 and 5-gm. portions of nitrate of soda, respectively. Slightly more nitrogen was recovered where the 10-gm. portion of nitrate was used than where the 5-gm. portion was used, and this is true whether the nitrate was used alone or in conjunction with manure. . . . Letting 100 represent the general average recovery for nitrate of soda, the recoveries for the other materials used were as follows: Ammonium sulphate 65.9; dried blood 60.7; solid manure, fresh, 36.4; solid and liquid manure, fresh, 49.1; solid manure, leached, 39.9. and solid and liquid manure, leached, 43.7.

"In general the percentage of nitrogen in the dry matter was slightly higher where manure and nitrogenous fertilizers were used together than where either was used alone. Likewise there was a tendency for it to be higher with the 10-gm. portion of nitrate than with the 5-gm. portion. The percentage of nitrogen in the dry matter was higher for the third rotation than for either the first or second.

"Lime in the form of carbonate had a pronounced beneficial effect upon the yields in general. The improvement was greatest where it was used in conjunction with ammonium sulphate. . . . Where manure was used with ammonium sulphate, the former counteracted, in a measure, the acid tendency of the latter. Lime and green manure crops, in conjunction with manure and the nitrogenous fertilizers, gave the largest yields of dry matter and nitrogen. . . .

"Notwithstanding the fair applications of manure and nitrogenous fertilizers, the cylinder soils have gradually lost in content of total nitrogen, though the loss has been greater on some than on others. Loss of nitrogen was greater with solid manure, fresh, than with solid and liquid, fresh; it was greater with the solid and liquid, leached, than with the solid, leached. The loss was almost as great with 5 gm. of nitrate of soda as with 10 gm. Generally speaking, the loss was greater where manure and nitrogenous fertilizers were used together than where either was used alone; where ammonium sulphate and dried blood were used in equivalent amounts, the loss was greater with the former. . . .

"Where the nitrogenous fertilizers were used alone there was but little recovery of nitrogen through the residual crop. Where nitrate of soda and dried blood were used in conjunction with green manures, there was a fair recovery of residual nitrogen, but the nitrogen thus recovered must not all be credited to the fertilizing materials. Where manure was used alone, or in conjunction with nitrogenous fertilizers, there was, without exception, some recovery of residual nitrogen. . . .

"It is concluded from the data here presented that the destruction of nitrates—that is, denitrification, does not take place to any great extent in general farming, under average field conditions, even when liberal amounts of barnyard manure are used.

"It is not possible to maintain the nitrogen supply of the cultivated soils by the use of commercial nitrogenous materials alone when used in the ordinary amounts. Even with liberal applications of manure and nitrogenous fertilizers covering a period of fifteen years, the nitrogen content of soil under constant cultivation was not maintained. The loss of nitrogen is attributed largely to loss through leaching."

Cylinder experiments relative to the utilization and accumulation of nitrogen, J. G. Lipman and A. W. Blair (*New Jersey Stas. Bul. 289 (1916), pp. 3–88, figs. 18*).—Seven years' experiments with a 4-year rotation of corn, potatoes, oats, and rye on two types of sand, fine sand, two types of sandy loam, two types of loam, and gravelly loam soils are reported, the purpose of which was to determine the relative value of the nitrogen of sodium nitrate, green manure crops, and stable manure. The sodium nitrate was used at the rate of 160 lbs. per acre, green manure crops consisting of crimson clover, vetch, soy beans, and cowpeas were seeded after each main crop, and stable manure was used at the rate of 15 tons per acre applied once in two years.

"The fertilizer treatment provides for two cylinders each without any fertilizer, two with minerals only, two with minerals and nitrate of soda, two with minerals and green manure, and two with minerals and stable manure, for each type of soil. All soils received a treatment of ground limestone when the experiment was begun, and similar applications at the end of each 5-year period."

Determinations of soil nitrogen after 5 years showed that "there has been a gradual depletion of the nitrogen content of the soil for six out of the eight types, even where nitrogenous fertilizers have been applied and where green manure crops have been grown. The soils from the check cylinders show the lowest percentage of nitrogen. The soils from the cylinders which receive minerals only and those which receive minerals and nitrate of soda show essentially the same percentage of nitrogen. The soils from the cylinders which receive minerals and green manure, and from those which receive minerals and stable manure, likewise show practically the same percentage of nitrogen, and this amount is about 0.01 per cent higher than in those cylinders where minerals only and minerals and nitrate of soda are used. It thus appears that the green manure crops have been quite as effective in maintaining the nitrogen supply of the soil as stable manure at the rate of 15 tons per acre applied once in two years. . . .

"The unfertilized cylinders gave the lowest yield of dry matter and nitrogen, and those that received minerals only the next highest. The cylinders that received minerals and nitrate of soda gave a higher yield of dry matter and nitrogen than those that received minerals only. . . . The highest yields of nitrogen and dry matter were from cylinders where green manure crops have been grown, and the next highest from those where stable manure has been used."

Calculation of the percentages of nitrogen recovered from sodium nitrate and stable manure showed that "in most cases this recovery was low for both the nitrate and the manure. The average recovery for nitrate for the 7 years was 39.59 per cent and for the manure it was 11.04 per cent. . . .

"Of the different types of soil the Norfolk sand gave the lowest yield of dry matter and nitrogen and the Quinton sandy loam the highest yield. The Penn loam stands next to the Quinton sandy loam. . . . On the Norfolk sand and Elsinboro fine sand the nitrogen supply of the soil has just been maintained by the use of green manure and stable manure. On the other six types the nitrogen supply is now less than when the experiment was begun, even where green manure and stable manure have been used.

"Since the yields with the green manure have, on the average, been greater than with stable manure, and since the nitrogen supply of the soil has been maintained on a level with that on the stable manure cylinders, it seems fair to conclude that the green manure crops have furnished at least as much nitrogen each year as the stable manure, and . . . that a small or moderate green

manure crop (none of the crops were large) will supply 70 to 80 lbs. of nitrogen per acre, which is equivalent to about 450 to 520 lbs. of nitrate of soda."

Lime nitrogen fertilizer experiments in 1915, AHR (*Mitt. Deut. Landw. Gesell., 30 (1915), No. 48, pp. 732–737*).—Sixteen series of experiments, comparing lime nitrogen with ammonium and nitrate fertilizers when added as a top-dressing to rye and wheat and before seeding to oats, potatoes, and beets in amounts equivalent to 15, 15.5, 20, 22.5, 30, 45, and 60 kg. of nitrogen per hectare (13.35, 13.8, 17.8, 20.025, 26.7, 40.05, and 53.4 lbs. per acre), are reported.

It was found that with few exceptions the nitrogen additions favorably influenced the yield. In fourteen of the series ammonium sulphate had in general a considerably more favorable influence than lime nitrogen. Lime nitrogen when added before seeding was, however, slightly more favorable to beets and potatoes than was ammonium sulphate. In one series lime nitrogen when added before seeding gave as good results as ammonium nitrate and better results than any of the other nitrate forms used. The results with lime nitrogen as a top-dressing for potatoes were very poor, and lime nitrogen was much less favorable for beets than was ammonium nitrate. The results as a whole are taken to indicate that the action of nitrogenous fertilizers is influenced by local environmental factors, especially soil and climatic conditions and kind of crop grown.

It was found in further experiments that mixing lime nitrogen with pulverized bog iron ore increased the fertilizing action of the lime ntrogen for winter wheat and rye, but not for oats. The results of experiments with a mixture of lime nitrogen with superphosphate were inconclusive.

Experiment on the effectiveness of some new ammonium salts as compared with sodium nitrate, ammonium sulphate, lime nitrogen, liquid manure nitrogen, and some organic nitrogenous fertilizers, P. WAGNER (*Mitt. Deut. Landw. Gesell., 30 (1915), No. 47, pp. 714–720, figs. 3*).—Pot culture experiments on loam and sand soils with sodium nitrate, ammonium sulphate, sodium-ammonium sulphate, ammonium carbonate, ammonium chlorid, blood meal, liquid manure, castor-bean meal, powdered and granulated lime nitrogen, a wool fertilizer, and an organic fertilizer, when added in amounts equivalent to 0.5, 1, and 1.5 gm. per 20 kg. of soil to summer rye, summer wheat, and white mustard, are reported.

Considering the effectiveness of ammonium sulphate as 100, with reference to both yield and nitrogen utilization, the effectiveness of sodium-ammonium sulphate was 93 for both, of ammonium carbonate 102 for yield and 103 for nitrogen utilization, of ammonium chlorid 104 and 98, of lime nitrogen 104 and 105, of blood meal 98 and 100, of liquid manure 91 and 94, of castor-bean meal 72 and 63, of the organic fertilizer 49 and 48, and of wool fertilizer 21 and 25. No difference was observed in the results obtained with lime nitrogen of different degrees of fineness.

Potash supplies during the war (*Bd. Agr. and Fisheries [London], Spec. Leaflet 42 (1915), pp. 4*).—This leaflet points out briefly the importance of the preservation and use of potash in barnyard manure, crop residues, seaweed, and wood ashes during the coming year, and discusses the liberation of soil potash by liming and applying sodium salts. Suggestions for the treatment of particular crops are given.

Potash: Review of the present position, A. BRUCE (*Trop. Agr. [Ceylon], 45 (1915), No. 1, pp. 4–14*).—This is a review of the present potash situation, with special reference to its effect on tropical agriculture. A table showing the ash and potash contents of various tropical plants is included.

The composition of wood and plant ash, R. A. BERRY (*Jour. Bd. Agr.* [*London*], *22* (*1915*), *No. 8, pp. 766–768*).—Analyses of representative samples of the ash of certain forest and plant products and of flue dust, made at the West of Scotland Agricultural College to determine their potash and phosphate contents, are reported. The following table summarizes the analyses:

Ash analyses of miscellaneous materials.

Kind of ash.	Total potash (K_2O).	Percentage of total potash soluble in water.	Phosphate of lime ($Ca_3(PO_4)_2$).
	Per cent.	*Per cent.*	*Per cent.*
Bracken	20.45	51.9	7.35
Spruce	11.94	68.9	15.30
Mixed forest produce	3.13	47.9	3.36
Hardwood, engine fire	10.44	64.8	10.95
Softwood, forest fire	11.79	55.4	11.41
Hardwood, largely oak trimmings	3.53	77.9	2.40
Flue dust from blast furnaces, No. 1	3.75	56.8	(1)
Flue dust from blast furnaces, No. 2	3.93	67.2	(1)

[1] Not ascertained.

Composition of bat guano from Uruguay, J. SCHROEDER (*Rev. Assoc. Rural Uruguay, 44* (*1915*), *No. 9, pp. 529–531*).—Analyses of two samples of this guano are reported, showing total nitrogen 5.59 and 6.93 per cent, total phosphoric acid 7.45 and 5.54 per cent, and potash 3.14 and 2.78 per cent. While this guano compares favorably in composition with guanos from North America and South Africa, it is said to be too limited in amount to be commercially profitable.

Fertilizing value of sugar beet crowns and leaves (*Dept. Landb., Nijv. en Handel* [*Netherlands*], *Verslag. en Meded. Dir. Landb., No. 4* (*1915*), *pp. 90–100; abs. in Jour. Bd. Agr.* [*London*], *22* (*1915*), *No. 8, pp. 759, 760*).—Analyses of sugar beet crowns and leaves are reported, together with the results of field tests to determine the effect of plowing under the beet crowns and leaves on oats and potato crops following beets. The analyses showed nitrogen varying from 2.24 to 2.37 per cent, phosphoric acid from 0.73 to 0.78 per cent, and potash from 2.88 to 3.23 per cent.

At the Lauchstädt experiment station it was found that plowing under the beet leaves and crowns was accompanied by a marked increase in the oat and potato crops and in the percentage of the larger sized potatoes. The increase in the potato crop was greater where the beet crowns and leaves were used without additional fertilizer. Where leaves and crowns were tested separately the largest increase in potato crop was obtained with the crowns. The potato crop produced with leaves alone was slightly greater than that produced with leaves and crowns together, but was much less than that produced by leaves and crowns and ammonium phosphate or by ammonium phosphate alone.

Inspection of commercial fertilizers, 1915, F. B. MUMFORD and P. F. TROWBRIDGE (*Missouri Sta. Bul. 139* (*1916*), *pp. 58, figs. 2*).—This bulletin contains the results of actual and guarantied analyses and estimated valuations of 494 samples of fertilizers and fertilizing materials collected for inspection in Missouri during 1915, together with a list of brands registered in the State during 1915 and a statement of the substance of the Missouri fertilizer law. It was found that of the official samples analyzed 35.5 per cent gave a total value averaging $1.28 a ton below guaranty.

Analyses and valuations of commercial fertilizers and ground bone. Analyses of agricultural lime, C. S. Cathcart et al. (*New Jersey Stas. Bul. 287 (1915), pp. 3–68*).—This bulletin contains the results of actual and guarantied analyses and valuations of over 1,000 samples of fertilizers and fertilizing materials, including analyses of 43 samples of ground bone, 45 samples of lime, and 32 samples of such sundry materials as tobacco stem ash, boneblack, prepared humus, tobacco stems, street sweepings, incinerator ashes, seaweed, flue dust, wood ashes, burned peat, cacao shells, hardwood ashes, humus, sludge, fish meal, and sewage residue, collected for inspection in New Jersey during 1915 in continuation of work noted in Bulletin 285 (E. S. R., 34, p. 625.)

AGRICULTURAL BOTANY.

Plant life, C. A. Hall (*London: A. & C. Black, 1915, pp. XI+380, pls. 74, figs. 80*).—This book, while popular as regards content and style, and intended primarily for nature lovers and amateur botanists, deals with most of the main divisions and topics usually considered in connection with a more formal and scientific study of plant life, including a chapter on fossil plants.

Mass mutation in Œnothera pratincola, H. H. Bartlett (*Bot. Gaz., 60 (1915), No. 6, pp. 425–456, figs. 15*).—This article, while considered to be of a preliminary character as regards many genetic relationships between the mutations and the parent species, reports a continuation of studies previously noted (E. S. R., 33, pp. 221, 524). It deals with mutations of *Œ. pratincola*, which gives rise, in successive generations, to mutations belonging to several distinct types. The most conspicuous of these, when young, is *Œ. pratincola nummularia*, originating in every generation from seven of the eight independent strains which have been studied. The eighth strain exhibits the phenomenon which has been called by the author "mutation en masse," and has been designated as Lexington E. This differs from all the other strains of *Œ. pratincola* in that it gives rise to a characteristic group of four mutations, that these occur in such large numbers as to justify the use of the term mass mutation, and that it does not give rise to the mutant *Œ. nummularia* and certain other mutations produced by strains which do not show mass mutation.

Œnothera gigas nanella, a Mendelian mutant, H. DeVries (*Bot. Gaz., 60 (1915), No. 5, pp. 337–345*).—The author gives an account of studies as a result of which he states that *Œ. gigas* produces dwarfs (about 1 to 2 per cent) and mutant hybrids of normal stature, which, after self-fertilization, give from 15 to 18 per cent (theoretically 25 per cent) of dwarfs. These mutant hybrids mendelize after self-fertilization, yielding about 18 per cent of dwarfs, 25 per cent of normal specimens of tall stature, and 57 per cent of hybrids of the same type. The latter gave among their progeny about 21 per cent of dwarfs. The mutant hybrids, fertilized by *Œ. gigas nanella*, yield from 30 to 43 per cent (theoretically 50 per cent) of dwarfs.

In artificial crosses with *Œ. gigas* the dwarfs follow Mendel's law. The production of dwarfs from *Œ. gigas* by means of mutation is, therefore, considered as requiring the copulation of two gametes, both of which are potentially mutated into dwarfs. The mutant hybrids, then, it is thought, must be the result of the fertilization of a mutated gamete by a normal one. They are correspondingly less rare than the dwarfs themselves. In view of the fact that dwarfs of *Œ. lamarckiana* do not follow the law of Mendel, either in their origin by mutation or in artificial crosses with the parent species, these conclusions are thought to show a new differential character between *Œ. gigas* and its parent species.

Three types of commercial vanilla in Tahiti, COSTANTIN and BOIS (*Compt. Rend. Acad. Sci.* [*Paris*], *161* (*1915*), *No. 8, pp. 196–202*).—Discussing three types of vanilla in Tahiti, the authors state that the type called Mexican vanilla is *V. planifolia*, that the type called Tahitan vanilla is closely related thereto, but that the type which has been provisionally called *V. tiarei*, and which is thought to have appeared there five or six years ago from an unknown source, may be a variation or a hybrid. It is said to possess qualities of commercial value.

Quichua names of sweet potatoes, O. F. COOK (*Jour. Wash. Acad. Sci., 6* (*1916*), *No. 4, pp. 86–90*).—The author gives some results of studies carried out by himself as a member of the Yale Peruvian Expedition, conducted by Prof. H. Bingham in cooperation with the National Geographic Society and the U. S. Department of Agrictulture.

It is stated that the Quichas, who live on the eastern slopes of the Andes, use and have used apparently from antiquity the names "apichu" for the sweet varieties of *Ipomœa batatas* and "cumara" for the starchy kinds, the inclusive term "camote" being used for both kinds by those who speak Spanish. Both these varieties are represented by local strains having local names, a number of which are given. Wild sweet potatoes are also said to be common in the valleys of the interior.

It is stated that, while among all the native names used in other parts of America there appears to be no definite resemblance to the Quichua words "apichu" and "cumara," the number and variety of such names testify to the American origin of the sweet potato, or at least to its wide distribution in prehistoric times. The name "cumara," or "kumara," is also used for the sweet potato in Polynesia. This fact is regarded as more than a mere coincidence.

Physico-chemical studies in botany.—I, Germination, HELENE NOTHMANN-ZUCKERKANDL (*Internat. Ztschr. Phys. Chem. Biol., 2* (*1915*), *No. 2–3, pp. 94–106*).—This is a review of the results and conclusions published by previous investigators on germination.

The germination, under aseptic conditions, of Zea mays in the presence of some quinonoids, D. ROUDSKY (*Compt. Rend. Soc. Biol.* [*Paris*], *77* (*1914*), *No. 20, pp. 30–33, fig. 1*).—Describing the behavior of maize seedlings grown by placing sterilized seeds on cotton in test tubes, the author notes that, while in case of the control tubes containing water only the roots penetrated the liquid freely and atttained considerable development, in tubes containing a dilute solution of an azin, a diamidoacridin, or one of two oxazins, the roots failed to descend into the solution, a portion of the rootlet showing also a certain coloration extending to the growing part. The lowering of the liquid surface of the solution due to evaporation was followed by renewed growth of the rootlet, in some cases carrying its point into the liquid, this fact suggesting a degree of adaptation to a medium which at first appeared to inhibit growth.

Light and growth, II, A. H. BLAAUW (*Ztschr. Bot., 7* (*1915*), *No. 8, pp. 465–532, figs. 10*).—The author has followed up his work previously reported (E. S. R., 34, p. 223) with studies on plantlets of *Helianthus globosus* as regards rate of growth and response to illumination of various intensities and durations.

It is held that in multicellular organisms a characteristic growth reaction is produced which is due to physico-chemical change. Phototropism is a secondary phenomenon of the growth reaction to light which results when the plant is subjected to unequal illumination on different sides. Plant cells are not stimulated because of obliquity of light or of unequal intensity thereof on different sides. There is no perception of light or of differences of illumination, but light produces alterations in growth rate which may quickly manifest themselves through a striking response.

The stimulation of protoplasmic streaming by rays of different sorts, HELENE NOTHMANN-ZUCKERKANDL (*Ber. Deut. Bot. Gesell., 33 (1915), No. 6, pp. 301–313, figs. 2*).—It has been found that visible ultraviolet and ultra-red rays cause in the plasma of leaf cells of Elodea streaming movements, the activity of which increases with the wave length. While the establishment of a temperature gradient by local warming in case of a single leaf caused streaming movements, the warming of the whole shoot by immersion in water had no influence in this connection.

The pigments of fruits in relation to some genetic experiments on Capsicum annuum, W. R. G. ATKINS and G. O. SHERRARD (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 25, pp. 328–335*).—Presenting results of a preliminary nature from a study of the genetics of fruits of *C. annuum*, the authors state that in these fruits red is dominant to yellow and appears to be a simple dominant to chocolate and orange. Differences in the shades of green in unripe fruits are ascribed to variations in the numbers of chromatophores contained in each cell. The colors of ripe fruits are due to red, chocolate, orange, and yellow plastid pigments. Red and chocolate have not been shown to be due to a mixture of pigments. Some red fruits contain water-soluble yellow pigment in small quantities.

Red and chocolate pigments, when pure, are oily liquids which have not been obtained in a crystalline condition. This property, with their ready solubility in cold alcohol and petroleum ether, distinguishes them from lycopin, carotin, and xanthophyll, the solutions becoming colorless when allowed to evaporate in sunlight. Carotin is moderately soluble in cold pyridin and yields crystals from this solvent similar to those from ethereal solution.

Peroxidase in Capsicum fruits diminishes as they ripen and bears apparently no simple relation to variety. The enzym is frequently present only in the epidermis, while the deeper tissues may contain an inhibitor with a strong reducing action.

The origin and transformations of anthocyanin products, F. MOREAU (*Bul. Soc. Bot. France, 61 (1914), No. 7–9, pp. 390–405*).—Referring to the view expressed in an earlier communication (E. S. R., 33, p. 523), that mitochondria take part in the formation of anthocyanin both in flowers and in vegetative organs, the author states that his later studies appear to indicate that the conclusions formerly announced should be considered as subject to modification by the results of investigation of more abundant material under more favorable conditions.

It is now held that anthocyanin in floral or vegetative parts may be of mitochondrial origin. On the other hand, in numerous cases the anthocyanin appears not to have been formed wholly in the chondriosomes or the anthocyanin corpuscles, but to have been preceded by the formation of colorless products which become colored more or less slowly. The colored anthocyanin products may themselves be transformed into colorless products. It is considered proper, therefore, to rank along with the red, violet, and blue pigments now designated as anthocyanins the colorless compounds which are inseparable from them for purposes of study and which are always found in the cells as earlier or later products, being closely related to them as regards chemical composition and as having in common with them a mitochondrial origin.

Oxidases and their inhibitors in plant tissues.—IV, The flowers of Iris, W. R. G. ATKINS (*Sci. Proc. Roy. Dublin Soc., n. ser., 14 (1915), No. 24, pp. 317–327*).—In this work the list of Iris flowers previously employed for a study of peroxidase reactions (E. S. R., 31, p. 626) has been extended greatly and much of the previous work has been repeated with a view to finding out how

far the activities of oxidizing enzyms depend upon the age of the flower and other factors, such as illumination.

It is stated that peroxidase reactions of certain species and varieties of Iris are similar, though the distribution and quantity of anthocyanin may be very different. Peroxidase reactions are well marked in the Xiphion group, variable as regards distribution in the Apogon group, and absent in the Pogoniris group. Active peroxidase increases more or less in Iris flowers kept in darkness, and the production of organic peroxid was recorded in one case. Owing presumably to complications introduced by inhibitors, it is impossible in Iris to correlate the distribution of peroxidase and anthocyanin, the latter frequently appearing in the absence of the former in an active state.

The formative starches of green leaves and their utilization, F. W. NEGER (*Naturwissenschaften, 3 (1915), No. 31, pp. 407, 408*).—Discussing the carbohydrate content of green leaves, the time at which it is greatest, and the possibility of its more economical utilization, the author notes some findings reported by former investigators or obtained by himself.

Observations on the starch content of several plants show that in these cases the maximum, while it may occur at different hours, generally falls in the afternoon or evening. The starch content of leaves and its transfer appear in most cases to be diminished under very high temperatures. The practice of gathering vegetables late in the afternoon is most profitable only when the accumulation of carbohydrates during this period is not too largely neutralized by its transfer to the stems before its sale and utilization the next day.

In regard to the removal of the leaves, which is suggested, starches tend to change into sugars, due to the presence of a ferment in the leaves, the activity of which seems to bear some rather intimate relation to respiration. It is suspended in irrespirable gases, but is resumed after removal therefrom if they are of a nonpoisonous character. In case of leathery leaves or, in particular, those of evergreens, the stores of carbohydrates are often larger, being the net accumulations of several days. The mobility of starch is much less in evergreen than in deciduous leaves. It is stated that the foliage of conifers contains, particularly in autumn and spring, large quantities of starch in a stable condition.

The starch economy of green plants, F. W. NEGER (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 8–9, pp. 370–380*).—This is a more detailed account of the facts summarized in the article noted above.

Starch formation in underground portions of herbaceous plants, J. D'ARBAUMONT (*Bul. Soc. Bot. France, 61 (1914), No. 5–6, pp. 347–351*).—The author has followed the work of Guilliermond (E. S. R., 28, p. 524) in the study of starch formation as related to leucoplasts. He states that besides the concentric development of the starch grain there may be noted two other phases, namely, a peripheral phase developing centripetally and one developing both centripetally and centrifugally at the same time from the periphery and the center, respectively. These and related phenomena are discussed as noted in different plants.

Humus as a source of carbon for green plants, M. MOLLIARD (*Rev. Gén. Bot., 27 (1915), No. 313, pp. 1–9*).—The author gives an account of experimentation from which he concludes that humus can not be considered a direct source of carbon for green plants to any appreciable extent.

The rôle of the ash constituents in living plants, I, M. A. EGOROV (*Zhur. Opytn. Agron., 16 (1915), No. 4, pp. 270–280*).—In a preliminary account of the relation between ash constituents and maturation it is stated that oats remain green after being desexed. It is thought that the direct cause of maturation in the Gramineæ, so far as that is manifested in the yellowing of the plant, is the

transfer of magnesium in considerable quantity to the grains, where it is fixed.

The root nodules of Ceanothus americanus, W. B. Bottomley (*Ann. Bot. [London], 29 (1915), No. 116, pp. 605–610, pl. 1*).—Giving an account of investigations on *C. americanus*, the author states that the root nodules of this plant are modified lateral roots, perennial in character and increasing each year by the formation of endogenous outgrowths or branches structurally similar to the branch from which they primarily arise. Each primary nodule or branch develops four zones designated respectively as meristematic (apical), infection, bacterial, and basal. The younger bacterial cells contain rod-shaped organisms, the older ones spherical bodies, the latter being the bacteroid condition of the active nitrogen-fixing rod-shaped bacillus. The bacteria, when isolated and grown in pure culture, are able to fix atmospheric nitrogen and are considered to belong to the *Bacillus radicicola* group.

The aerating system of Vicia faba, C. Hunter (*Ann. Bot. [London], 29 (1915), No. 116, pp. 627–634, figs. 6*).—A description is given of the aerating system demonstrated for *V. faba*. It is thought that the division of the air cavities in young internodes facilitates gas interchange in the active region of the growing point. It is suggested that the production of lysigenic cortical air cavities in old internodes is a device to assist in respiration by the cortical cells of the old root. The development of the intercellular space system of the root tip is thought to show the great importance of the aerating system in the most active regions of cell development.

On the coagulation of Hevea latex and a new method of coagulation, B. J. Eaton and J. Grantham (*Agr. Bul. Fed. Malay States, 4 (1915), No. 2, pp. 26–30*).—Reporting work designed to test the hypothesis of Whitby (E. S. R., 29, p. 149) that the spontaneous coagulation of Hevea latex is brought about by a coagulating enzym, the author claims that these experiments indicate that this natural coagulation of the latex of *H. brasiliensis* is due to certain bacteria which infect the latex after collection. There are two types of organism, one (favored by aerobic conditions) which tends to inhibit coagulation and produces an alkaline slime in the presence of air, and the other (favored by anaerobic conditions) which effects coagulation of the latex. The coagulation of the latex under anaerobic conditions is not constant, owing, it is thought, to a variation in the constitution of the latex. By the addition of various sugars, coagulation under both aerobic and anaerobic conditions always occurs. This is thought to be explainable on the supposition that a medium is formed more favorable for the organisms which produce coagulation and less favorable to those producing putrefactive changes.

The assimilative capability of witches' brooms on cherry, E. Heinricher (*Ber. Deut. Bot. Gesell., 33 (1915), No. 5, pp. 245–253, figs. 2*).—It is stated that, in experiments described, considerable assimilation of carbon dioxid was accomplished by the foliage of witches' brooms in case of cherry.

Dwarfing effect of trees upon neighboring plants, J. Y. Bergen (*Bot. Gaz., 60 (1915), No. 6, pp. 491, 492*).—Discussing the factors generally mentioned in connection with the deficient growth of plants in the shade of trees, namely, shading, abstraction of water and of salts, and the possible excretion of injurious substances by the trees, the author records observations made during the very rainy summer of 1915, in Cambridge, Mass., on some growing plants shaded by a belt of deciduous trees.

It is stated, regarding *Aster novæ-angliæ, Asclepias tuberosa*, and *Helianthus grosse-serratus*, that, while none of these flourished as well as did other individuals growing in open ground, all were perhaps twice as tall as during an

ordinary season and were much more robust than usual. A specimen of *Chelone glabra* grew luxuriantly and flowered freely, though for some years it had barely kept alive. On the other hand, the rather xerophytic *Sedum telephioides* and *Hedera helix* showed no better growth than usual, and some other plants, as *Saponaria officinalis* and *Oxalis corniculata*, showed little increase over their usual size. It is thought that the differences noted were due to increased water supply, and that many plants of agricultural importance may be as sensitive to the effects of diminished water supply as the Aster, Asclepias, and Helianthus previously mentioned.

Radium and plant growth (*Gard. Chron., 3. ser., 58 (1915), No. 1501, p. 209*).—In comments on the results of a number of experiments said to have been carried out by M. H. F. Sutton, it is stated that in no case was it apparent that any of the radium preparations had a beneficial effect on the growth of the crops. In not a few instances there were definite indications that the preparations had exercised an adverse influence on the plants.

Bibliography on the effect of sulphur dioxid on vegetation and animal life (*U. S. Dept. Int., Bur. Mines Bul. 98 (1915), pp. 503–520*).—This bibliography, which is said to have been prepared by the chemists' club library of the Selby Smelter Commission, lists nearly 100 articles upon the biological effects of sulphur dioxid, giving notes or brief abstracts of most of the articles mentioned.

Disappearance of sulphur dioxid from dilute mixtures of sulphur dioxid with air, G. C. Bartells, Jr. (*U. S. Dept. Int., Bur. Mines Bul. 98 (1915), pp. 308–323, pls. 2*).—These investigations were carried on to test certain observations made in the field fumigation experiments previously noted (E. S. R., 35, p. 28).

It is stated that the disappearance of sulphur dioxid from a mixture thereof with air, when introduced into a carboy containing green vegetation, was found to be due in great part to absorption of sulphur dioxid by the plant, but in some degree also to the oxidation of the sulphur dioxid in an excess of moist air and to absorption by the surface of the glass. Experimentation showed also that when a mixture of sulphur dioxid and dry air was left in a glass container, there was a disappearance of the sulphur dioxid to the extent of about 10 per cent in 30 hours. The disappearance was greater when the air showed a relative humidity of 50 per cent than it was in dry air, and much greater at a humidity of 100 per cent. When a mixture of sulphur dioxid and air was exposed to the action of direct sunlight, a gradual disappearance of the sulphur dioxid took place. This was greatest when the temperature was highest, which fact is considered to preclude the view of its solution by water. In all cases both oxidation and absorption took place to an extent which was greater in a moist than in a dry atmosphere.

Defects in the investigation of smoke injury, S. Eicke (*Ztschr. Pflanzenkrank., 25 (1915), No. 1, pp. 45–59*).—Discussing the methods, results, and present state of study of the relations between soil, plant, and smoke, also between smoke and the aerial portions of plants, the author calls attention to some of the gaps in our present knowledge in this connection.

Tests of various brands of litmus for bacteriological work, Christie J. Mason (*Connecticut Storrs Sta. Bul. 83 (1915), pp. 126, 127*).—The author gives a report on an investigation of different brands of litmus to determine their adaptability for bacteriological purposes, basing her conclusions on the numbers of bacteria which developed in litmus-lactose-gelatin plates prepared for testing milk or its products. Of the four brands of litmus tested, litmus cubes were found to be the most satisfactory though the difference between azolitmin and litmus cubes was slight. The other forms of purified litmus are said to have inhibited the growth of bacteria to a noticeable degree.

An electric incubator for bacteriological work, W. M. Esten (*Connecticut Storrs Sta. Bul. 84 (1915), pp. 139–146, figs. 3*).—The author describes an electric incubator which he has made that proves to be inexpensive, serviceable, and durable. One of these incubators, made for the Carnegie Institution of Washington, was 30 by 18 by 14 in. inside measurement and cost, including labor and material, $70.85. This has been in use for three years and has given excellent satisfaction. A trial incubator made by the author has been in constant use for 10 or 12 years and has proved thoroughly satisfactory.

FIELD CROPS.

[Experiments with field crops in Barbados] (*Rpt. Dept. Agr. Barbados, 1914–15, pp. 2–32*).—Experiments with sugar cane conducted at 16 estates included a comparison of seedling varieties with the White Transparent as a standard. The results show that B. 6450 yielded on the average 5.76 tons of cane, or 1,727 lbs. of saccharose per acre more than White Transparent, and that B. 6032 yielded on the average 5.57 tons of cane, or 1,334 lbs. of saccharose per acre more than B. 6450. Results are also reported on a comparison of seedling canes, including B. 6450, with White Transparent when grown as plant canes and rattoons on the black and red soils of the island. These results also generally favored the seedling canes. In a fertilizer experiment with sugar cane in which each fertilizer application supplied nitrogen at the rate of 60 lbs. per acre, sulphate of ammonia apparently produced 101 lbs., nitrate of ammonia 334 lbs., nitrolim 495 lbs., and nitrate of lime 547 lbs. of saccharose per acre more than was secured from the use of nitrate of soda.

The results of selection experiments with cotton are reported in tables which also include a description of the different varieties and strains which entered into the test. The work in progress represents an effort to improve the indigenous varieties of cotton.

The results of variety tests with cassava, economic Colocasieæ, Caladiums, and Xanthosomas, leguminous crops, yams, and grasses are presented in tabular form with brief notes.

[Experiments with field crops at the Tortola experiment station], F. Watts (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. Tortola, 1914–15, pp. 7–15*).—In a variety test with sugar cane harvested as first rattoons, B. 6450 ranked first with a yield of 19.2 tons of cane per acre, and this was the only variety giving a high yield in an unfavorable season. Experiments with cotton varieties showed that St. Vincent was larger and more vigorous than St. Kitts and also exhibited a greater power of resistance to dry weather. In a comparison of cassava varieties, Blancita ranked first with a yield of 7 tons per acre. The results of tests with sweet potatoes in 1914–15 showed the heaviest yields from Harper, Anguilla, and Bourbon, producing 13,024, 11,584, and 10,304 lbs. per acre, respectively. The best yields of peanuts 1,500 lbs. per acre, were secured from the Gambia and Dixie Giant varieties.

Various strains of cotton originated from St. Kitts seed were tested and the yields of seed-cotton were found to range from 988 to 1,118 lbs. per acre. Field and laboratory notes on the cotton-selection work are given.

[Experiments with field crops at the St. Kitts-Nevis experiment stations], F. Watts (*Imp. Dept. Agr. West Indies, Rpt. Agr. Dept. St. Kitts-Nevis, 1914–15, pp. 2–14*).—In a test of 13 varieties of sweet potatoes, Caroline Lee, Playwell, and Brass Cannon ranked first and yielded in the order mentioned over 1,500 lbs. of crop per acre. The results of variety tests with yams in progress for 11 years gave first rank to French No. 3 with an average yield of 14,376 lbs. per acre followed by Jackroe with 12,420 lbs.

Fertilizer experiments conducted with cotton gave the highest increase over the check plat, which received no manure, in the case of the plat receiving nitrogen as nitrate of soda, potash in the form of sulphate, and phosphoric acid as basic slag. The results of fertilizer trials over a period of 11 years are regarded as showing that under the conditions existing at the experiment station where the soil is loose and open, the application of commercial fertilizers is not remunerative.

Notes are given on selection work with cotton, and the results thus far secured are regarded as encouraging although unfavorable weather conditions reduced the yields. Minor experiments with peanuts, guinea corn, maize, tobacco, Rounceval peas, and species of Stizolobium are briefly noted.

[Work with field crops on the government experiment farm at Akola, Berar, for the year 1914–15], J. H. RITCHIE (*Dept. Agr. Cent. Prov. and Berar [India] Rpt. 1914–15, pp. 1–15, pl. 1*).—A description of the farm is given and the lines of work are briefly noted. The results of experiments are presented in tabular form.

In a rotation experiment cotton followed by wheat and cotton followed by tur proved the most profitable rotations under test. The wider spacing of cotton plants, 15 in. each way or 15 by 20 in., proved most satisfactory, and this is considered due to the selection of seed that has been carried on and which has influenced the branching habit of the plants. Topping cotton plants proved an unproductive practice. Among the varieties, Rosea cotton as in former years proved the most valuable, and selected Rosea gave better returns than the unselected strain. Poudrette was found to be the most economical manure for cotton and juar grown in rotation.

The production of green forage during the entire year, A. C. TONNELIER (*Min. Agr. Nac. [Buenos Aires], Dir. Gen. Enseñanza e Invest. Agr. [Pub.], No. 41 (1915), pp. 125, pl. 1, figs. 32*).—The value of green forage during the entire year and the methods of producing it are discussed. The crops considered in this connection are the soy bean, cowpea, velvet bean, corn, nonsaccharin sorghums, millets, barley, vetches, horse bean, lupins, and Jerusalem artichokes. Tables are given showing the composition of the different crops, the time each occupies the land, the number of cuttings, the average quantity of green forage produced, the average rainfall during the growing period, the time of seeding, sprouting, and harvesting, and other popular information of a similar nature.

The number of temporary roots in the cereals, R. G. WIGGANS (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 31–37, pl. 1*).—This paper reports data gathered with reference to the number of temporary roots in corn, wheat, einkorn, and emmer. The results of the study are given in tables with brief comments. The germination tests from which the data were obtained were made in the laboratory at about optimum temperature and moisture conditions for seed germination. The radicle is considered as the first temporary root and is included in all the figures given.

It is concluded from the results secured that the various groups of corn and of wheat do not have a regular number of temporary roots. The dent corns and pop corns tested had four temporary roots in a greater percentage of cases than any other number. It is believed that the flint and probably the sweet corns have one temporary root in more cases than any other number. The soft corns varied greatly in all cases in the number of temporary roots produced. In the various groups of wheat the greatest percentage produced five temporary roots instead of three as is ordinarily reported.

The production and handling of grain in Argentina, L. DUVAL (*U. S. Dept. Agr. Yearbook 1915, pp. 281–298, pls. 12*).—This article describes the cereal producing region of Argentina; points out the importance of cereal and flax production in that country; and describes the methods of growing, handling, and marketing of corn, wheat, oats, and flax, special attention being given to the classes of corn grown, the planting, harvesting, and storing of the crop, and to the seeding, harvesting, and threshing of wheat, oats, and flax. The classes and varieties and types of wheat commonly grown are briefly noted. A description is given of the grain storage facilities of the country and of the classification and inspection of grain and of grain contracts. The use of warehouse certificates in the grain trade is briefly explained.

Seed corn for the 1916 crop, H. D. HUGHES and W. W. STANFIELD (*Iowa Sta. Circ. 28 (1916), pp. 3–16, figs. 6*).—The results of a study of seed-corn conditions in the State are reported and methods of testing seed-corn are described. The general survey revealed that in many localities the quantity of seed-corn available was sufficient for planting the next crop provided the corn showing considerable vitality be given the individual ear test to remove the worthless ears.

From tests made at the station the cost was found to be from 15 to 45 cts. for each hundred ears, the difference being due to the method used. The cost of testing by the Rag Doll method was 18 cts. and by the saw-dust box method 27 cts. Complete directions for the use of the Rag Doll tester are given.

During the fall of 1915, 220 lots of seed-corn of 20 ears each were picked on different dates, the first on October 4 and the last or eleventh series of lots on December 13. Two selections were made each week, one of the most mature ears and the other of immature or soft ears. Each of the 4,400 ears was tested late in February. The results showed that of the mature ears picked at weekly intervals and stored in seed houses with continuous heat 74 per cent gave strong germination; the same quality picked at the same time but stored in a closed shed with no artificial heat, 35 per cent; and of those stored in an open shed only 11 per cent gave strong germination. The more immature seed corn picked at weekly intervals and cured and stored in the seed house with artificial heat gave 54 per cent; those in a closed shed 14 per cent; and those in an open shed 10 per cent.

Cotton—varieties and limiting factor tests, W. L. HUTCHINSON (*South Carolina Sta. Bul. 185 (1916), pp. 19*).—This bulletin reports some results of experiments with cotton conducted in 1913, 1914, and 1915. The results of variety tests are given in tables with brief comments. The rainfall during the growing season is also shown.

Thirty varieties were tested at the Pee Dee substation in 1914 and 1915, many of the varieties being grown in both years. In 1914, Cook Improved headed the list with a yield of 2,205 lbs. of seed-cotton per acre, 39 per cent of lint, and 860 lbs. of lint per acre, the total value of the crop produced being $130. The range in lint production for the 30 varieties was from 401 to 860 lbs. per acre and the percentage of lint from 30 to 39. In the test of 1915 the variety Pulnott ranked first in yield of lint per acre with 949 lbs., and in total value of crop with $146.20 per acre. The range in yield of lint per acre for the 30 varieties this year was from 523 to 949 lbs., and the percentage of lint from 29 to 39. Cook Improved this year ranked third in the yield of lint per acre with 889 lbs., but ranked first in the percentage of lint.

The main station in 1913 tested 21 varieties in small groups. The varieties showing special merit and their yields of seed-cotton per acre were as follows: Simpkins Ideal 1,763 lbs., Petway 1,731 lbs., Kitchings 1,664 lbs., Cook Improved 1,526 lbs., and a hybrid between King and Triumph 1,405 lbs. In a test

of 24 varieties in 1915, Double Limbed stood first in the rate of yield of seed-cotton with 2,442 lbs. per acre, in the yield of lint per acre with 810 lbs., in the yield of seed per acre with 1,632 lbs., and in total value of crop per acre with $129.84. The range in percentage of lint of the 24 varieties was from 30 to 39 per cent, Cook Improved leading in this respect. In yield of seed cotton per acre the varieties ranged from 1,145 lbs. to 2,442 lbs.

At the Pee Dee substation, experiments were conducted in 1914 and 1915 to determine the limiting factor or factors of cotton production, and a similar test was conducted with corn. The results secured with both crops given in tables show that for the two seasons, nitrogen was the principal limiting factor, but moisture may become the factor which limits the production in some seasons.

Studies on the cotton plant in Egypt, W. L. BALLS (*Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 8, pp. 1017–1023, fig. 1*).—This article summarizes briefly the work of the author with cotton in Egypt and groups the conclusions arrived at in these studies with reference to agricultural practices, including irrigation, spinning requirements, plant physiology, plant breeding, and genetics. A bibliography of 49 references is presented in conclusion.

Comparative spinning tests of the different grades of Arizona-Egyptian with Sea Island and Sakellaridis Egyptian cottons, F. TAYLOR and W. S. DEAN (*U. S. Dept. Agr. Bul. 359 (1916), pp. 20, figs. 2*).—A report is presented on spinning tests with the different grades of Arizona-Egyptian cotton compared with each other as to waste, tensile strength, bleaching, mercerization, dyeing, and finishing qualities, and also compared with Sakellaridis Egyptian and Sea Island cottons. The tests were conducted on the 1914 crop and the different lots tested included one bale each of extra, choice, standard, and medium Arizona-Egyptian cotton; three bales of Sakellaridis Egyptian cotton of the grades good, fully good fair, and fair; and two bales of Sea Island cotton of the grades fancy and extra choice. The results are given in tables and are briefly discussed.

The relative waste of the four grades of Arizona-Egyptian cotton was as follows: Extra 17.69 per cent, choice 18.56 per cent, standard 20 per cent, and medium 20.9 per cent. With respect to grade the four bales of this cotton were found to be proportionately less wasty than the two bales of Sea Island, and these again were proportionately less wasty than the three bales of Sakellaridis.

No relation was found to exist between the price of the different kinds of cotton and the percentages of waste discarded in the manufacturing processes. Arizona-Egyptian was estimated to be lower in commercial value than Sea Island and Sea Island lower than Sakellaridis, when equivalent grades were compared. No significant relationship was observed between the tensile strength of the respective grades of Arizona-Egyptian cotton, and the difference in the tensile strength of yarns made from the three kinds was practically negligible, although the average results were somewhat in favor of the Sakellaridis Egyptian cotton with the Sea Island standing second. The tensile strength for the highest number of yarns was in favor of the Sea Island cotton. It is concluded from the results that our domestic cottons are equal and in most respects superior to imported cottons.

The results of a laboratory test indicated that after bleaching, dyeing, and mercerizing, the Arizona-Egyptian and Sea Island cottons were practically equal to each other and slightly superior to the Sakellaridis in their bleaching and mercerizing properties. They were also found to be fully equal to each other in dyeing properties, but in tensile strength the advantage was slightly in favor of the Sea Island and Sakellaridis. The finished gray and mercerized yarns were comparatively equal in luster, the yellow color being a little more evident

in the Arizona-Egyptian than in the Sakellaridis, which in turn was somewhat more yellow than the Sea Island.

Râb: A unique system of cultivating rice in western India, E. Buck (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 8. pp. 1111–1117*).—This system is described and discussed with reference to the effect of the different practices which it involves.

It is pointed out that among the general features of the system the more prominent ones are that the rice is transplanted from the seed bed to the field, that the seed bed and not the field is manured, and that by burning the manure its effectiveness is increased. The term "râb" refers to manure burned on the seed beds from which rice plants are transferred to the field, and at one time the manure thus burned consisted mainly of branches and twigs of trees and bushes of the surrounding jungle. The advantages of transplanting and of the manuring of the seed bed are considered and an analysis of the heating effect in its various aspects is presented. It is shown that one of the advantages of transplanting is the possibility of economizing in the use of manures, since their application to the seed bed instead of to the field gives a greater efficiency for a given quantity and incurs less expense in the application.

A study made by H. H. Mann et al. from 1909 to 1912 on the effect of heat on the chemical, physical, and biological character of the soil, the effect of the ash constituents on the plants, and the effect of heat alone compared with that of the ash and of each with that of the complete application used in the "râb" system, is briefly reviewed and the results summarized. In this study the analysis of the water-soluble constituents of the soil before and after heating showed a steady increase in the amounts of soluble minerals and organic matter with increase of temperature. An increase in permeability was found to be proportional to the increase of temperature. A similar increase in permeability brought about by the addition of gypsum was only able to effect an increase in yield of about one-fourth of the amount produced by heating the soil.

With regard to the biological effects of heat on the soil it was found that the activity of the aerobic organisms as measured by the rate of absorption of oxygen was very largely reduced on heating to 125° C. for half an hour, but never wholly destroyed, and that after 7 weeks it greatly exceeded that in the unheated soils. It is concluded that since the growth of the seedlings is greatest immediately after heating when the aerobic activity is lowest, the fertility of the soil is not dependent on the presence of large numbers of soil organisms during the growth of the plants. It is pointed out that investigators have shown that nitrogen in the form of ammonia is the most effective manure for rice and that greater yields are obtained by applying it before planting than at intervals during the growth of the crop, and from this fact it is concluded that the heating effect of the râb system seems to produce ideal conditions in the seed bed as it causes a temporary increase in ammonification of the soil at the most favorable period in the development of the rice plant.

See also a previous note (E. S. R., 27, p. 641).

The cost of producing sugar beets, F. W. Peck (*Minnesota Sta. Bul. 154 (1916), pp. 3–35, figs. 11*).—The results of a study of the cost of sugar beet production showed that man labor constituted 49.5 per cent of the total cost of production. Without contract help the growers required an average of 155.4 hours per acre to produce the crop. The average cost per acre for both contract and noncontract labor was $23.61. The average rate per acre for professional labor was $17.19, or 20.6 cts. per hour. With contract or outside labor the grower spent 34 per cent, and without it 11.5 per cent of his labor in marketing the beets.

Horse labor was found to constitute 21 per cent of the cost, 110.6 horse hours being required, costing at 10 cts. per hour $11.06. The average of all farms gave a cost of $9.97 per acre for horse labor, of which one-third was spent in marketing the beets.

The average rate of seeding was 17 lbs. per acre at a cost of $2.57 with the seed at 15 cts. per lb. The machinery cost varied with the use or nonuse of the manure spreader, but averaged $1.21 per acre. Commercial fertilizer was applied in 5 of the 11 localities studied, but the results in yields gave no indication of its value. The average cost per acre was $1.78 for about 120 lbs. On these farms from 6 to 16 loads of manure were usually applied for the beet crop and the labor of application, the only charge made, amounted to $3.66 per acre. Land rental constituted 15 per cent of the total cost, the average cash rental paid and interest at 6 per cent on owned land amounting to $7.74 per acre.

The total cost of production per acre was $47.65. On the average normal yield basis of 9.82 tons per acre, the cost was $4.85 per ton. The receipts were $5 per ton in each case, leaving a profit of 15 cts. or $1.45 per acre. In addition to this the producer received $7.74 per acre as land rent and $23.31 as pay for his own labor, a total income over other expenses of $32.50 per acre. With the employment of contract labor, the producer had $15.31 per acre for rent, for his own labor, and for profit.

The yields varied from 5 to 22 tons per acre with a normal average for the three years of 9.82 tons. The average of the estimates of the value of beet tops by the growers was $4.40 per acre. It was also estimated that an increase of 6 bu. of wheat and of 4 to 6 bu. of barley and oats may be expected when these crops follow sugar beets.

Sweet potato culture in Arkansas, W. H. Wicks (*Arkansas Sta. Bul. 124 (1915), pp. 3–31, figs. 21*).—This bulletin is a brief popular treatise on the culture of sweet potatoes in Arkansas. The topics discussed are location of field, selection of seed, varieties, propagation, the soil—its preparation and fertilization, planting, cultivation, harvesting, storing, and marketing. Notes are also given on the importance of the sweet potato industry of the State, and on the cost of production and the returns that may be expected.

The fire-holding capacity of tobacco leaves as a factor in tobacco breeding, D. Hoffmann (*Fühling's Landw. Ztg., 64 (1915), No. 13–14, pp. 366–371*).—This article discusses the importance of the fire-holding capacity of tobacco leaves, and points out certain difficulties encountered in breeding for a high quality in this respect. A report is also given of counts made to determine the possible seed production of tobacco plants and of the length of time the leaves of certain selected plants continued to glow in a burning test.

The results of the seed counts indicated that an average plant may produce 202,300 seeds. In 1914 the duration of glow of 150 unfermented leaves ranged from 10 seconds to the complete incineration of the leaf. Fire-holding capacity appeared to be a heritable character. It is stated that the plants under test were selected on the basis of color and structure of leaf, characteristic of plants with a high potash content, and of early maturity.

Alaska and Stoner, or "Miracle" wheats: Two varieties much misrepresented, C. R. Ball and C. E. Leighty (*U. S. Dept. Agr. Bul. 357 (1916), pp. 28, figs. 6*).—The history of the two varieties of wheat is reviewed at some length, and the results of comparative tests made by several experiment stations and this Department are presented in tabular form and discussed.

In summarizing the experimental results it is pointed out that Alaska wheat has failed to produce even fair yields when tried in many parts of the country,

and that it is not as good a milling wheat as many other widely grown varieties. It is further concluded that Stoner wheat does not differ essentially in value from many other wheats now widely grown in the eastern United States. The variety did not outyield all varieties in any of the tests made nor did it rank above all others in tillering capacity. The use of 20 to 30 lbs. of seed per acre was found insufficient for the production of maximum yields.

The seed field, H. L. Bolley (*North Dakota Sta. Circ. 12 (1916), pp. 4*).—Brief popular directions are given for growing seed of different farm crops on the farm.

Agricultural seed, G. P. Burns (*Vermont Sta. Bul. 192 (1916), pp. 3–40*).—A report is made in tabular form on the analysis of 343 samples of agricultural seed offered for sale in the open markets of Vermont. The guarantied and actual purity percentages and the approximate number of weed seeds in a pound are given, together with the amount of ergoted grain found in the timothy and red-top samples. In discussing the results of the inspection it is pointed out that of 337 samples 204 were equal to or better and 133 were below the standard of purity proposed by this Department. A synopsis of the Vermont seed law setting forth the duties of the wholesaler, retailer, and the station is presented, and advice to the farmer regarding the purchase of seed and the use to be made of the seed analyses published by the station under the law is given.

How seed testing helps the farmer, E. Brown (*U. S. Dept. Agr. Yearbook 1915, pp. 311–316, pls. 2*).—The inefficiency of certain state seed laws is pointed out in this article, together with the influence of the enforcement of the federal seed importation act on the quality of imported seeds. Some of the practices in adulterating seeds are briefly noted. A list of publications of this Department which bear on the testing of seeds is given. It is stated that seed testing helps the farmer by telling him what part of the seed is alive, of what kinds it consists, and how many weed seeds it contains, and also by furnishing the means of discovering and preventing the sale of adulterated and low-grade seeds.

It is reported that tests of samples of foreign seed showed that between July 1, 1914, and October 1, 1915, over 300,000 lbs. of light-weight orchard grass seed was imported which contained an average of only 28 per cent of seed, the remainder being chaff and dirt. Nearly 2,500,000 lbs. of crimson clover seed imported during the 6 months following April 1, 1915, contained an average of only 54 per cent of live seed, and of this quantity the germination of 500,000 lbs. averaged but 38 per cent. It is also mentioned that in the spring of 1915 the importation of rape seed resulted in market supplies of three distinct plants sold as winter rape: (1) Winter rape, a biennial forage crop with fleshy, succulent roots, furnishing an abundance of forage the first year and seeding the second year after planting; (2) oil-seed rape similar to winter rape in its early stages but maturing seed in midsummer of the first year of growth; and (3) turnip rape, an oil seed producing turnip of but little forage value as compared with winter rape.

HORTICULTURE.

China, a fruitful field for plant exploration, F. N. Meyer (*U. S. Dept. Agr. Yearbook 1915, pp. 205–224, pls. 8, fig. 1*).—This comprises a popular résumé of the author's explorations in China in search of information relative to plant industries and plant material that might be adapted to conditions in the United States.

A genetic analysis of horticultural varieties propagated by vegetative means, D. F. Jones (*Proc. Soc. Hort. Sci., 12 (1915), pp. 137–141*).—A short paper on this subject in which the author advocates an analytic study of plant varieties usually propagated by vegetative means before attempting to improve such plants by breeding operations.

Myrtaceous possibilities for the plant breeder, P. J. Wester (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 3, pp. 207–215*).—In continuation of a previous article dealing with the annonas (E. S. R., 29, p. 642) the author here describes 64 species of myrtaceous plants with edible fruit of which 20 belong to the genus Psidium, 19 to the genus Eugenia, and scattered species to 13 other genera. The subject matter is presented with the view of calling the attention of horticulturists and breeders to the valuable plant material among the myrtaceous plants.

Garden calendar for 1916 (*Montgomery, Ala.: Agr. and Indus. Dept., Immigr. and Markets Bur., 1916, pp. 2*).—This calendar, which is prepared with special reference to Alabama conditions, contains notes on flower plantings, succession crop combinations for vegetables, and vegetable planting tables.

Fungicide and insecticide inspection (*Maine Sta. Off. Insp. 75 (1916), pp. 8*).—A report on analyses of 33 samples of fungicides and insecticides analyzed by the station during 1915, with a discussion by A. M. G. Soule.

[Spraying in Oregon] (*Oreg. Agr. Col. Bul. 228 [1916], pp. 32*).—This bulletin consists of two sections. The first, on Orchard Spraying in Oregon, 1916, by H. P. Barss and A. L. Lovett (pp. 3–24), gives information relative to the more important diseases and insect pests of various orchard fruits and their control, including directions for making spray mixtures. In the second, Spraying Machinery, by V. R. Gardner (pp. 25–32), the author calls attention to the adaptation of spray machinery of different types to particular orchard conditions.

Report of the experimental fields of the Chamber of Agriculture of the Province of Hanover in Poppenburg for the year 1914, O. Hollmann (*Landw. Jahrb., 48 (1915), No. 5, pp. 659–716, pls. 10, fig. 1*).—Experiments conducted with peas, beans, and cabbage in 1914 are reported. The experiments deal chiefly with cultural methods, variety tests, and methods of controlling diseases.

Asparagus, R. W. DeBaun (*New Jersey Stas. Circ. 57 (1916), pp. 4*).—This circular discusses the method of establishing an asparagus field, planting, care the first season, care during and after the cutting season, fertilizers, insect enemies and disease, and harvesting the crop.

Sand for cabbage seed bed, M. G. Kains (*Country Gent., 81 (1916), No. 14, p. 745*).—In connection with a study of the effects produced by various soil mixtures on the root development of early cabbage being conducted at the Pennsylvania Experiment Station, preliminary results indicate the desirability of using for the seed bed a soil composed largely of sand. The sand seems to stimulate the development of roots by forcing them to reach for food and at the same time retards the early development of tops. Because of their strength the plants seem to be able to resist disease to a greater extent than do plants grown by the ordinary methods.

Studies in lettuce breeding, C. E. Durst (*Proc. Soc. Hort. Sci., 12 (1915), pp. 96–98*).—This paper discusses chiefly crosses made at the Illinois Experiment Station between open heading and close heading varieties of lettuce.

Inheritance in tomatoes, G. W. Hood (*Proc. Soc. Hort. Sci., 12 (1915), pp. 88–95*).—The experiments here described were started by the author at the Michigan Experiment Station in 1912 and later continued at the Nebraska Sta-

tion, where the F_2 and succeeding generations were grown. A number of crosses were made with the object of studying the unit characters found in dwarf and standard varieties as well as to produce some superior commercial variety. Data secured from various crosses of F_1 and F_2 generations are here presented and discussed.

Tomato growing in California, S. S. ROGERS (*California Sta. Circ. 147 (1916), pp. 12*).—A revision of Bulletin 239 (E. S. R., 29, p. 540).

Acreage of fruits in California, bearing and nonbearing, in 1915, G. P. WELDON (*Cal. Fruit News, 53 (1916), No. 1450, p. 5*).—A statistical compilation showing the bearing and nonbearing acreage of various fruits and nuts in California in 1915.

Orchard management investigations, J. OSKAMP (*Proc. Soc. Hort. Sci., 12 (1915), pp. 44–47*).—In this paper the author briefly outlines an experiment in orchard soil management which has been under way in southern Indiana for a period of five years. No results are presented in this paper.

Orchard economics, M. W. RICHARDS (*Proc. Soc. Hort. Sci., 12 (1915), pp. 47–50*).—A discussion of management costs reported from a representative apple orchard included in the system of community demonstration orchards inaugurated by the Purdue Experiment Station some five years ago.

The water supply and fruit bud formation, W. PADDOCK (*Proc. Soc. Hort. Sci., 12 (1915), pp. 51–54*).—In this paper the author reviews some data secured in orcharding experiments at the New Hampshire Experiment Station (E. S. R., 33, p. 44) with the view of showing that the amount of moisture present in the ground about the time when fruit buds begin to differentiate is an important factor in the development of fruit buds.

The science of orchard heating, C. NICHOLS (*Proc. Soc. Hort. Sci., 12 (1915), pp. 22–27*).—This comprises a brief review of the history of the development of frost protection devices, including brief descriptions of a number of forms now in use.

The root systems of nursery apple trees, J. K. SHAW (*Proc. Soc. Hort. Sci., 12 (1915), pp. 68–72*).—In this paper the author discusses chiefly the influence of different apple scions on the root systems usually employed for grafting apple trees. A number of observations based on an investigation of the interrelation of root and scion in apples started at the Massachusetts Experiment Station in 1912 are also presented.

The results of apple pruning investigations, W. H. ALDERMAN (*Proc. Soc. Hort. Sci., 12 (1915), pp. 54–59*).—This comprises a preliminary report of experiments started by the West Virginia Experiment Station in 1911 in which trees in several orchards were given varying amounts of dormant pruning. The results secured in the various orchards are here grouped together and discussed with special reference to the effect upon vigor, growth, and fruitfulness of the amount of pruning and season of pruning.

Thus far the results secured indicate that heavily pruned trees do not make as satisfactory a gain as lightly pruned trees, either in total length of growth or in increase of trunk diameter. In young trees heavy pruning has delayed fruit bearing and light pruning encouraged it. In old trees that have been bearing for some time and were in a fair state of vigor at the beginning of the experiment, the vigorous pruning stimulated fruit production.

With reference to difference in season of pruning, in every case either heavy or moderate dormant pruning stimulated a greater growth than any of the summer prunings. The reduction in vigor was less in the case of early summer pruning than in either repeated or midsummer prunings. Summer pruning caused a great decrease in the size of leaf, number of leaves per tree, and total

leaf area per tree. The leaves were also deficient in chlorophyll. Data secured in young orchards indicate that summer pruning has a detrimental effect, if any, with reference to early bearing. Merely corrective dormant pruning far exceeded all forms of summer pruning in bringing about early bearing and in some cases the moderate and heavy dormant pruned trees produced more bountifully than did the summer pruned trees.

Some points on the general care of apple orchards, J. P. Stewart (*Proc. State Hort. Assoc. Penn., 55 (1914), pp. 89–95, pl. 1*).—In the present article consideration is given to methods of securing early bearing, the control of aphids and red bugs, and the fruit pit disease or "stippen." A provisional list of varieties with reference to their susceptibility to fruit pit is also given.

Irrigation of peaches, L. D. Batchelor (*Utah Sta. Bul. 142 (1916), pp. 3–23, figs. 13*).—This bulletin presents the results of irrigation experiments started in a 3-year-old peach orchard in 1912.

Data secured in 1913–14 showed that frequent applications of irrigation water applied to peaches on a gravel loam soil at intervals of 7 or 8 days produced a more continuous and greater total twig growth than the same total amount of water applied with larger applications at intervals of every 10 to 12 days. The more porous the soil the more frequently the trees should be watered.

Evidence was secured showing that the trees may receive an unnecessary amount of water. The maximum duty of irrigation water applied to peaches on a gravelly soil was 31 acre-inches during the years 1913 and 1914. This amount of water produced a total twig growth practically equal to that produced by 62 acre-inches of water.

With the same total amount of water applied on a gravel loam, there is a regular increase in crop production the more frequent the irrigation. No amount of water applied early in the season to a crop of peaches on a gravelly soil will compensate for the lack of water during the month before harvest.

Poor color of fruit was associated with an insufficient amount of irrigation water. High color of fruit was associated with late watering, that is, watering at intervals during the latter part of the growing season up to harvest time.

Some peculiar forms of winter injury in New York State during the winter of 1914–15, W. H. Chandler (*Proc. Soc. Hort. Sci., 12 (1915), pp. 118–121*).—The author describes a form of winter injury to peach buds observed in the spring and summer of 1915 in which the pith of the bud and even the pith of the twig at the base of the bud was injured, there being also a slight injury to the xylem and some to the cortex. The apparent result of this injury was a retardation of the blooming and leafing period of from 2 to 3 weeks. As the summer progressed a normal crop of fruit was developed and matured at approximately the same time as that on trees with uninjured fruit buds.

Similar observations were made on pear trees. In the case of the pears, however, the entire fruit spurs on many trees were injured, this resulting in the loss of the crop. Where the injury did not cover all of the spur the trees showed some recovery.

A stone-fruit spray made from hydrated lime and sulphur, G. C. Starcher (*Virginia Sta. Bul. 210 (1916), pp. 3–14, fig. 1*).—Preliminary field experiments were conducted in 1915 to determine the value of hydrated lime and sulphur as compared with the usual sulphur sprays used for stone fruits. A series of laboratory studies was also conducted relative to the constancy and methods of preparing the hydrated lime and sulphur solution.

As tested for one season the hydrated lime and sulphur solution gave good results as a fungicide with very little spray injury. In view of these results

and the advantages in preparation over the ordinary sulphur sprays, it is recommended to peach growers for trial on a limited scale.

A spraying schedule is given for insects and fungus diseases of the peach in which hydrated lime and sulphur is substituted for the summer treatment of self-boiled lime-sulphur.

Some results in the breeding of small fruits, R. D. ANTHONY (*Proc. Soc. Hort. Sci., 12 (1915), pp. 121–125*).—This paper discusses some results secured in breeding work with raspberries and strawberries which is being conducted at the New York Geneva Station. The subject matter is discussed under the following general headings: Purple raspberries, dwarf types in raspberries, a correlation in leaf and fruit color among raspberries, and inheritance of sex in strawberries.

Fragaria virginiana in the evolution of the garden strawberry of North America, S. W. FLETCHER (*Proc. Soc. Hort. Sci., 12 (1915), pp. 125–137*).—In this paper the author presents considerable evidence to support the conclusion that the garden strawberry of North America is of mixed origin, with *F. virginiana* and *F. chiloensis* predominating.

Experiments with stocks for citrus, W. W. BONNS and W. M. MERTZ (*California Sta. Bul. 267 (1916), pp. 275–301, figs. 12*).—The authors give a brief review of the literature dealing with the use of various stocks for citrus and describes experiments with citrus stocks being conducted at the Riverside Citrus Station. The principal results to date as measured by the first five crop years are substantially the same as those noted in a previous summary of the work (E. S. R., 33, p. 736).

The pitanga, A. D. SHAMEL and W. POPENOE (*Jour. Heredity, 7 (1916), No. 4, pp. 179–185, figs. 2*).—A descriptive account of the pitanga (*Eugenia uniflora*) with reference to its botany, distribution, habits of growth, the fruit and its uses, propagation, and culture.

A spotting of citrus fruits due to the action of oil liberated from the rind, H. S. FAWCETT (*California Sta. Bul. 266 (1916), pp. 261–269, figs. 2*).—This bulletin describes experiments made by J. D. Culbertson and the author with the view of determining the cause of "green spot" on citrus fruits, more especially lemons.

The experiments show that at least one of the causes of such spotting is due to the effect of small quantities of oil liberated from the glands in the rind. The oil liberated from the rind by any cause appears to act powerfully and quickly upon all the cells at the surface with which it comes in contact, except those immediately surrounding the oil glands. The affected spots remain green while the remainder of the rind colors normally. Such fruits may be kept for weeks without enlargement of the spots and without change in their green color. Sometimes the green is replaced after a long time by a reddish or brownish color. This lowers the grade of the fruit but usually does not injure seriously its keeping quality.

A number of experiments were conducted with oil squeezed directly from the living rind of the fruit and also with measured quantities of commercially expressed lemon oil. The results of these experiments are summarized as follows: "The effect of a given amount of oil from the rind was greater on fruit in a moist atmosphere than on similar fruit in a dry atmosphere. The moisture being the same, the effect was greater on green or immature fruit than on fully colored or mature fruit. The effect was greater on fruit just picked than on similar fruit picked for some days. The action of small amounts of oil, for example, such as could be liberated by a hard pressure of the thumb against the rind of a dark-green freshly picked moist lemon (or by 0.01 cc. of the com-

mercially expressed lemon oil) was sufficient to cause the typical green spotting. The green color appeared to be fixed in the portion acted on by the oil, while the remainder of the rind colored normally in the usual process of curing in four to six weeks. The action of a large amount of lemon oil, such as 0.1 cc. or more, under the same conditions caused the spots to become brownish or reddish rather than green. When the amount was sufficiently increased the breaking down of the tissue was so great that blue mold started in a few days. When the fruits acted on by the oil were left attached to the tree, only in rare cases did the green color remain. As the fruits continued to grow and mature, the sunken areas were partially restored and only slight scars were left.

"Under similar conditions the oil from the rind of oranges acted upon other uninjured oranges in the same manner as did the oil from the rind of lemons act upon other lemons. The oil caused the spotting of tender leaves and shoots and the withering of flower buds when squeezed out upon them. The action of the oil on the surface of the rind is extremely rapid, as shown by the fact that 0.01 cc. of lemon oil acting for eight seconds was sufficient to show afterward a visible effect on the rind."

Green spotting has been observed almost exclusively on fruit picked during the late fall, winter, and early spring, which period corresponds to the season of moist atmospheric conditions in California, due to frequent rains and fogs. The remedial measures suggested by the present investigations are picking the fruit when free from rain or dew and the use of extreme care in handling fruit to avoid injuries or knocks that would tend to liberate the oil in the rind.

Cacao culture, A. Ribeiro de Castro Sabrinho (*O Cacauzeiro e Sua Cultura Intensiva. Rio de Janeiro: Min. Agr., Indus. e Com., 1915, pp. 25*).—A treatise on cacao culture, including information relative to climatic and soil requirements, varieties, propagation, planting, cultural operations, intercrops, methods of harvesting, and preparation for market. A brief bibliography on cacao culture is included.

The date palm in Egypt, T. W. Brown (*Agr. Jour. Egypt, 5 (1915), No. 1–2, pp. 63–79, pl. 1*).—An account of the date palm with reference to methods of propagation, planting operations, irrigation, soil, manures, intercrops, rate of growth, and the peculiarities of the male and female palms, with special reference to the process of hand pollination.

Report of the proceedings at the sixth annual meeting of the Northern Nut Growers' Association, Rochester, N. Y., September 1 and 2, 1915 (*North. Nut Growers Assoc. Proc., 6 (1915), pp. 77*).—In addition to the usual business of the association the following papers read at the meeting, together with a bibliography of the year of articles dealing with nuts and various phases of nut culture, are given: The Relation of Forest Conditions in New York to Possibilities of Nut Growing, by H. P. Baker (pp. 17–23); [Nut Survey of Pennsylvania], by F. N. Fagan (pp. 23–27); New Tree Crops and a New Agriculture, by J. R. Smith (pp. 30–35); Notes on the Hazels, by R. T. Morris (pp. 36–51); An Appeal to Owners of Hardy Nut Trees, by C. A. Reed (pp. 51–57); History, Dimensions, and Crop Records of Parent Northern Pecan Trees, and Notes on the Observation of Propagated Trees, by W. C. Reed (pp. 58–62); Walnut Observations in California, by L. D. Batchelor (pp. 63–68); Pruning the Persian Walnut, by J. G. Rush (pp. 69, 70); and Report on Nut Growing in Canada, by G. H. Corsan (pp. 71, 72).

Lawn making in California, J. W. Gregg (*California Sta. Circ. 149 (1916), pp. 8, fig. 1*).—This circular contains practical directions for the construction and maintenance of lawns, including also information relative to methods of controlling the weeds, rodents, and insects in lawns.

FORESTRY.

Forest conservation for States in the southern pine region, J. G. PETERS (*U. S. Dept. Agr. Bul. 364 (1916), pp. 14*).—This bulletin points out the essential elements in the various forest problems that confront the States in the southern pine region, shows how these problems are interrelated, and discusses methods for solving them, information being given relative to conservation legislation already in force in the different States and the nature of the assistance the Federal Government is prepared to offer to forestry in these States.

Renewing the shelter-belt, G. B. MACDONALD (*Iowa Sta. Circ. 27 (1916), pp. 16, figs. 18*).—This circular describes the following five methods for renewing the shelter-belts in Iowa: Regeneration from one side, regeneration from two sides, regeneration by clear cutting, regeneration by alternate rows, and regeneration by under planting. Each method is illustrated with drawings explaining how the work is carried on for a shelter-belt of average size, and a list is given of tree species suitable for use in the method.

Report on the activities of the Swedish Institute of Experimental Forestry during the 3-year period, 1912–1914, G. SCHOTTE and H. HESSELMAN (*Meddel. Stat. Skogsförsöksanst. (Mitt. Forstl. Vers. Anst. Schwedens), No. 12 (1915), pp. 9–70. I–XX, fig. 1*).—In addition to a brief statement of progress made in various divisions of the institute a schedule of investigations and other projects for the period 1915–1917 is also given.

Progress report of forest administration in the Province of Assam for the year 1914–15, A. R. DICKS and W. F. L. TOTTENHAM (*Rpt. Forest Admin. Assam, 1914–15, pp. [6]+26+53+5, pl. 1*).—The usual progress report relative to the administration of the state forests in the Western and Eastern Circles of the Province of Assam, including a financial statement for the fiscal year 1914–15. All important data relative to alterations in forest areas, forest surveys, working plans, yields in major and minor forest products, revenues, expenditures, etc., are appended in tabular form.

Two forest arboretums near Brussels, D. E. HUTCHINS (*Trans. Roy. Scot. Arbor. Soc., 30 (1916), pt. 1, pp. 1–14*).—Notes are given on the growth of various species of trees in the Groenendaal and Tervueren arboretums near Brussels.

The development of the vegetation of New York State, W. L. BRAY (*N. Y. State Col. Forestry, Syracuse Univ. [Pubs.], 16 (1915), No. 2, pp. 186, pls. 2, figs. 52*).—This study comprises as a whole an analysis of the history and present aspects in the development of the native vegetation in New York State, together with some consideration of the status of vegetation as modified by human action. The study was conducted with reference to its subsequent value in investigations along various phases of forestry and allied lines of work, such as fish and game propagation and protection and the control of injurious insects and fungi.

The subject matter is treated at length under the following general headings: A general review of classification, growth forms, and plant associations; landmarks in the geological history of vegetation; the glacial period and its effect upon vegetation; modern aspects of the plant geography of New York; the content, zonal relations, zonal features, and extra-continental relations of the New York flora; the sources of New York flora in general; development of vegetation as influenced by the substratum and the resulting influence upon the substratum; the bog sequence of vegetation; the development of vegetation upon a substratum subject to prevailing water deficit; the resemblance between heath bog and pine barren vegetation; general survey of xerophytic succession in New York; the development of mesophytic vegetation; climax vegetation; and

the status of New York vegetation under cultural conditions. A map showing the dominant trees in different sections of the State is appended.

The evergreens of Colorado, B. O. Longyear (*Fort Collins: State, 1914, pp. 80, figs. 58*).—This publication contains popular descriptions of the native evergreens of Colorado and also discusses the uses of evergreens, both from an ornamental and economic standpoint; methods of propagation and culture; and insect pests and diseases.

Qualities and uses of the woods of Ohio, W. R. Lazenby (*Ohio State Univ. Bul., 20 (1916), No. 9, pp. 75–111, figs. 18*).—In this paper the author reports studies relative to the structure and physical properties of woods taken from Ohio trees. Tabular data show the weight of the various woods in pounds per cubic foot and in kilograms per cubic decimeter.

Tests were made of 69 samples representing 62 species of hardwoods with the view of determining the relative rapidity of absorption and the amount of moisture absorbed by air-dried samples of Ohio woods, and the results are presented in tabular form and discussed. The data given show the weight in grams of water absorbed in seven days, as well as the original volume in cubic centimeters and the amount and percentage of increase in weight and volume.

Similar data are also presented on tests conducted with eight coniferous species of Ohio.

The paper concludes with an account of the kinds and quantities of woods used in Ohio and a classification of the principal and minor uses of various Ohio woods, as well as a list of useful products from wood and parts of trees.

Durability of timbers, P. Groom (*Trans. Roy. Scot. Arbor. Soc., 30 (1916), pt. 1, pp. 44–46*).—An examination of the statistics dealing with the durability of various European and Indian timbers led the author to conclude that the color of the heartwood is no safe guide to the durability of wood. Although the most perishable woods appear generally to be light-colored, there are dark-colored woods which are by no means durable and some light-colored woods of exceeding durability. The present observations are in opposition to Mayr's law which states in substance that the more intense the color of the heartwood of timber the more durable it is.

Wood as building material, G. Lang (*Das Holz als Baustoff. Wiesbaden: C. W. Kreidels, 1915, pp. XXI+388, pls. 2, figs. 214*).—A manual of information relative to the growth, structure, physical properties, and uses of the more important woods.

Pointers on marketing woodlot products, S. L. Wolfe (*U. S. Dept. Agr. Yearbook 1915, pp. 121–130, pls. 4*).—In this paper the author offers a number of suggestions aimed to assist the farmer in securing the maximum returns from his woodlot.

Volume tables for timber estimating, T. Johnson (*Massatabeller för Träduppskattning. Stockholm: Zetterlund & Thelanders, 1915, 3. ed., pp. 96, figs. 3*).—This comprises tables for estimating the contents of logs and standing timber.

Success of aeroplane patrols, F. B. Moody (*Canad. Forestry Jour., 12 (1916), No. 4, pp. 471, 472*).—This note calls attention to the successful use of the aeroplane in detecting forest fires during the fire season of 1915 in Wisconsin.

Forest protection in Canada, 1913–14, C. Leavitt, C. D. Howe, J. H. White, et al. (*Toronto: Com. Conserv. Canada, 1915, pp. XIV+317, pls. 31, figs. 6*).—This report comprises a compilation of information dealing with forest protection in Canada collected under the direction of the committee on forests during the years 1913–14.

Part 1 treats at length of the railway fire situation and part 2 consists of reports of the committee on forests of the Commission of Conservation. The succeeding parts deal with forest fires and the brush disposal problem; the effect of repeated forest fires upon the reproduction of commercial species in Peterborough County, Ontario; the reproduction of commercial species in the southern coastal forests of British Columbia; and forestry on Dominion lands. Regulations governing the granting of yearly licenses and permits to cut timber on Dominion lands are appended.

Proceedings of forest industry conference of the forest protective organizations of the Pacific coast, composing the Western Forestry and Conservation Association, with state, federal, and British Columbia forest agencies, San Francisco, October 19, 20, 1915 (*Proc. Forest Indus. Conf. West. Forestry and Conserv. Assoc., 1915, pp. 31, figs. 10*).—In this report the following papers are included: Year's Results of Private and State Protective Work, by E. T. Allen (pp. 4, 5); The Government's Experience and Conclusions, by A. S. Peck (pp. 5–7); What the Season Taught British Columbia, by M. A. Grainger (p. 7); Fire Weather Forecasts, by E. A. Beals (pp. 7, 8); Railroad Fires, by F. A. Silcox (pp. 8, 9); Forest Protection and Modern Invention, by C. DuBois (pp. 9–11); The Psychology of Sentiment Making, by E. T. Allen (pp. 11, 12); The Business End of Cooperative Fire Work, by A. W. Laird (pp. 12–15); Compulsory Protection Laws, by C. S. Chapman (pp. 15, 16); Relations Between Eastern and Western Forestry Organizations as the East Hopes to See Them, by H. S. Drinker (pp. 17, 18); Our Relations as the West Hopes to See Them, by F. C. Knapp (pp. 18, 19); What the Magazine Can Do To Help, by P. S. Ridsdale (p. 19); Organization of Forest Owners in the East, by W. R. Brown (pp. 19, 20); Can Manufacturers, Timber Owners, and Protective Agencies Unite to Advantage? by H. D. Langille (pp. 20–22); Does the Lumber Industry Need Radical Reorganization to Protect Both Producer and Consumer? by E. B. Hazen (pp. 22–25); The Government and the Lumber Industry, by H. S. Graves (pp. 25–27); and Taxation and Forestry, by E. A. Selfridge, Jr. (pp. 27, 28).

The utilization of wood waste, E. Hubbard, trans. by M. J. Salter (*London: Scott, Greenwood & Son, 1915, 2. rev. ed., pp. XVI+192, figs. 50*).—This translation of the second edition of the author's work (E. S. R., 14, p. 1132) has been revised and enlarged to include more recent information relative to more advantageous methods of utilizing all wood waste.

DISEASES OF PLANTS.

Fruit and vegetable diseases and their control, E. C. Stakman and A. G. Tolaas (*Minnesota Sta. Bul. 153 (1916), pp. 3–67, figs. 32*).—This is a somewhat popular bulletin designed to give information regarding the plant diseases occurring in orchards and gardens in Minnesota. After preliminary directions regarding spraying, formulas are given for a number of the more efficient fungicides which are recommended. The diseases are described under an alphabetical arrangement of the host plants. A spray calendar for the control of insect and fungus pests on the more common orchard and garden plants concludes the bulletin.

Penicillium avellaneum, a new ascus-producing species, C. Thom and G. W. Turesson (*Mycologia, 7 (1915), No. 5, pp. 284–287, figs. 3*).—A description, together with cultural data, is given of *P. avellaneum* n. sp.

The genus Rhizoctonia in India, F. J. F. Shaw and S. L. Ajrekar (*Mem. Dept. Agr. India, Bot. Ser., 7 (1915), No. 4, pp. 177–194, pls. 6*).—Following up a previous account of work by Shaw on Rhizoctonia (E. S. R., 28, p. 149), the

authors herein give attention to *R. napi* and *R. destruens*, said to be of some economic importance in India. They also give a further discussion of the host relations as noted in India of *R. solani*, thought to be identical with *R. medicaginis*, and those of *Rhizoctonia* sp., said to have as its perfect stage *Corticium vagum*. The experiments and views of several authors are cited as regards the control of Rhizoctonia disease of economic plants.

Tests of spraying compounds (*Jour. Agr. [New Zeal.], 10 (1915), No. 1, pp. 35–40*).—Besides reports on tests with insecticides, results are given of trials made with several brands of fungicides by growers in cooperation with orchard instructors and managers of experiment farms in different districts of New Zealand. The discrepancies observed in the values are thought to be partly accounted for by regional and seasonable differences.

Tests of spraying compounds: Lime sulphur, T. W. KIRK (*Jour. Agr. [New Zeal.], 11 (1915), No. 2, pp. 129–134*).—Reporting on a continuation of the spraying tests noted above, the author states that as first used lime sulphur of American brands was found to do immense damage by scorching. Subsequent tests with modified strengths have shown its adaptability to local conditions, so that by its adoption a considerable reduction may be effected in the employment of Bordeaux mixture, which is found to produce a russeting effect on the fruit. A formula is given for a homemade solution of lime sulphur which is claimed to be as effective as the commercial preparation and less expensive. Results are given following tests of several brands as carried out in the Hawke's Bay district and reported by J. A. Campbell. Further tests are noted below.

Tests of spraying compounds: Lime sulphur, G. STRATFORD (*Jour. Agr. [New Zeal.], 11 (1915), No. 3, pp. 243–247*).—In continuation of the above reports, an account is given of the work as carried out in the Nelson district. The four brands of lime sulphur employed are regarded as effective fungicides, and it is thought that this preparation may largely take the place of Bordeaux mixture, which in this district also produces a russeting of the fruit.

As regards powdery mildew, which is said to be gradually increasing in almost all districts, lime sulphur is considered to be the only spray which can combat it successfully.

Disinfection of seed grain with hot water, H. M. QUANJER (*Ontsmetting van Zaaigranen met Heet Water. The Hague: Dir. Landbouw, 1914, 2. rev. ed., pp. 18, pl. 1*).—This is a discussion of several cereal diseases which may be introduced with the seed grain, those diseases control of which is possible or practicable, the suitability in particular of the hot-water treatment, its mode of application, and the expense connected therewith.

Review of measures taken in the Netherlands for control of grain and grass smut, and streak disease, H. M. QUANJER and J. O. BOTJES (*Meded. Rijks Hoogere Land, Tuin en Boschbouwsch. [Wageningen], 8 (1915), No. 3, pp. 129–160, pls. 3*).—This contribution, besides discussing the results of previous tests by other investigators and referring to the work of Quanjer (E. S. R., 30, p. 241), gives results of work by Quanjer on smut control and by Botjes on the sensitivity of various grains to copper sulphate and hot water. The latter treatment appears to be generally preferable, both on account of its results and because machinery for its cooperative employment is often already available in the appliances of dairy and laundry plants, the latter offering especial advantages as regards the drying of the grain after treatment so that it can be quickly sown.

The hastening of germination by both the hot water and the copper sulphate treatment is to be made the subject of further study and report.

Mildew of cereals in France, G. GAUDOT (*Jour. Agr. Prat., n. ser., 28 (1915), No. 54, pp. 520–522, figs. 2*).—This is a brief account of a report by Arnaud

already noted (E. S. R., 34, p. 243) regarding the appearance of *Sclerospora macrospora* on cereals in France.

Club root, A. H. COCKAYNE (*Jour. Agr.* [*New Zeal.*], *11* (*1915*), *No. 3, pp. 197–203, figs. 3*).—Club root is said to attack a number of cultivated crucifers and several weeds of the same family in New Zealand, where it is widely disseminated, being found in all classes of soils. It is thought that its appearance in calcareous soils may be due to the leaching of the lime from the upper layers in such localities, as acid soil conditions are much more favorable than alkaline to its development. The excrescences, due to a slime mold (*Plasmodiophora brassicæ*), are distinguished from swellings somewhat similar externally but caused by nematodes or else by hybridization. The organism is commonly distributed by the feet of stock.

Leguminous crops offer a ready means of rotation, which should be employed in connection with liming. Artificial fertilizers appear to increase the development of club root. The use of basic manures is advised. Basic slag has given good results in parts of the North Island. Certain varieties of swedes appear to be relatively resistant.

The potato blight in India, J. F. DASTUR (*Mem. Dept. Agr. India, Bot. Ser., 7* (*1915*), *No. 3, pp. 14, pl. 1*).—It is stated that late blight or leaf curl (*Phytophthora infestans*) of potato, which is prevalent in the hills in India, first made its appearance in the plains in 1899–1900. It disappeared after three or four years, but reappeared in a violent outbreak in 1912–13 at Bhagalpur and Rangpur, attacking also the tomato crop at the latter place. This latter appearance is ascribed to the use of seed tubers from Darjeeling and Naini Tal, where the disease seems to be present each year. Experiments and observations since carried out appear to show that the summer heat of the plains is sufficient to kill the parasite. It is accordingly recommended that seed procured from infected localities be obtained early enough to allow them to pass some part of the summer on the plains.

The gross and minute alterations in the plant due to the attack and progress of the parasite are described, more particularly the developmental phases of the haustoria and the influence of the fungus in producing deformation of the starch granules. Certain bodies regarded as resting conidia, produced in pure cultures on artificial media, are also discussed.

Late blight of potato, R. A. JEHLE (*Estac. Expt. Agron. Cuba Circ. 48* (*1915*), *pp. 3–6, pls. 4*).—This contains a brief discussion of the late blight of potato, due to *Phytophthora infestans*, which is is said to cause in Cuba the loss of a large part of the crop each year. Experiments there are said to have confirmed those made elsewhere as to the beneficial effects of a 5 : 5 : 50 Bordeaux mixture. The applications should begin when the plants are a few inches high and should be repeated at intervals of eight or ten days to suit the weather, at the rate of from 50 to 75 gal. per acre according to the size of the plants.

Treatment for late blight of potato, E. FOEX (*Jour. Agr. Prat., n. ser., 28* (*1915*), *No. 40, pp. 438–440*).—This discussion relates mainly to the experimentation reported by Pethybridge (E. S. R., 32, p. 239) in so far as that deals with the superiority of the Burgundy as compared with the Bordeaux mixture for *Phytophthora infestans*, or late blight of potatoes.

Wart disease of potatoes (*Gard. Chron., 3. ser., 58* (*1915*), *No. 1506, p. 294*).—A list is given of varieties of potatoes said to have been recommended by the Board of Agriculture and Fisheries for planting in 1916 on areas infected with wart disease in England and Wales.

The sugar beet nematode and its control, H. B. SHAW (*Sugar* [*Chicago*], *17* (*1915*), *Nos. 2, pp. 31–35, figs. 6; 3, pp. 56–60, fig. 1; 4, pp. 58–61; 5, pp. 58–63, figs. 8; 6, pp. 58–62, fig. 1; 7, pp. 55–58; 8, pp. 51–53; 9, pp. 54, 55*).—The author

gives results of a study since 1912 of the sugar beet nematode (*Heterodera schachtii*). The results obtained by others are also freely used, as appearing in the scattered but voluminous European literature covering a period of about 60 years. But little has as yet appeared in English on this subject.

The present distribution of the pest is very extensive, including a large portion of Europe and the Azores. In the United States it has become established in two of the oldest beet districts in California and Utah. It is distributed by tools, the feet, water, and numerous other agencies.

The life history of the nematode is outlined, the brown cyst stage being regarded as very important. Viable eggs and larvæ have been found in these cysts after four or five years, and their contents may withstand a considerable degree of cold, heat, and desiccation. It is thought, however, that a temperature of 63° C. (145.4° F.) for one minute destroys all life in this stage. The life cycle is said to occupy about four to five weeks, so that six or seven generations may be produced in one season. Each female produces from 350 to 400 eggs. The parasite attacks the plants during its larval stage, producing profound changes in their development and product.

Lists are given of plants found to be susceptible or otherwise. Advantage may be taken of this knowledge to starve out the pests by crop rotations which are outlined. Small infested spots may be isolated by trenches filled with lime. Chemical methods, as well as the method of trap plants, have been found to be impracticable in Europe. Exposure of the beet seed to a temperature of 65 to 70° for 5 to 10 minutes not only destroys all nematode life, but apparently stimulates the germinability of the seed. This method is claimed to be extremely simple, inexpensive, and practicable as applied to seeds, and it is recommended that such treatment of imported seed be made general.

A bibliography is given.

Spraying experiments at Ruakura, A. W. Green (*Jour. Agr.* [*New Zeal.*], *11* (*1915*), *No. 2, p. 134*).—It is stated, in a report of orchard work at Ruakura farm of instruction, that after this season's experiments there is little reason to doubt the value of lime-sulphur solution in this connection. Unsatisfactory results in previous experiments are attributed to the strength of the spray used.

Cedar rust eradication in Berkeley County (*Crop Pest Com. W. Va. Bien. Rpt. 1* (*1913–14*), *pp. 33–39, figs. 4*).—Besides a discussion of the relations of cedar trees to apple rust as regards control of the latter, an account is given of the concentration of effort in Berkeley County, the practical difficulties encountered in the removal of the cedars, and the results obtained thereby.

The eye rot of the apple, E. S. Salmon and H. Wormald (*Gard. Chron., 3. ser., 58* (*1915*), *No. 1506, p. 289, figs. 2*).—The authors report having received from growers in Wye, Sussex, and Devonshire apples showing a blossom end rot which may be causally connected with a fungus, apparently a Fusarium, found in some diseased fruits. In one case the diseased apples were densely infested with aphids. The authors recommend as tentative measures for protection the picking and burning of all affected fruit and the use of sprays for the destruction of puncturing insects.

The frog-eye leaf spot of apples, C. H. Crabill (*Virginia Sta. Bul. 209* (*1915*), *pp. 16, figs. 6*).—According to the author the frog-eye leaf spot is one of the most prevalent foliage diseases of the apple in Virginia, its attacks often causing serious loss. Various fungi have been attributed as causing this disease, but investigations of the author show that the initial infection and enlargement are caused by *Sphæropsis malorum*. *Alternaria mali* occurs as

a saprophyte, rapidly spreading through the spot behind the Sphæropsis, and may become a parasite under conditions of excessive moisture. *Phyllosticta pirina*, *P. limitata*, and *Coniothyrium pirinum* occur as saprophytes but are not able to produce enlargements. The light gray color about some frog-eye spots which have ceased to enlarge is said to be due to *P. pirina*. Other fungi reported as a cause of this disease are said to occur only as saprophytes.

A description is given of the relation of the fungus causing Sphæropsis spots to black rot and canker of the apple. Spraying experiments for the control of frog-eye leaf spot were conducted in various parts of Virginia from 1910 to 1914, lime-sulphur solution, Bordeaux mixture, iron Bordeaux mixture, and copper-lime-sulphur being employed. All of these fungicides greatly reduced the amount of injury, lime-sulphur ordinarily being somewhat more efficient than the others.

Dimorphism in Coniothyrium pirinum, C. H. CRABILL (*Amer. Jour. Bot.*, *2* (*1915*), *No. 9, pp. 449–467, figs. 15*).—Having dealt in a previous paper (E. S. R., 29, p. 648) with the morphology, cultural features, and host relationships of *C. pirinum*, the author reports the outcome of pure cultures of this fungus isolated from apple leaf spots.

It is stated that *C. pirinum* is sometimes dimorphic in culture and probably also in nature. Two strains have been isolated, a plus strain fruiting abundantly, and a minus strain fruiting poorly which arises in artificial culture by sudden sporting from the plus strain. Minus strains are said to remain constant generation after generation. Attempts to develop the strains from each other by continuous selection of extremes were unsuccessful. The cause of the sporting has not been ascertained.

The gray mold or Botrytis disease of citrus trees, C. C. BRITTLEBANK (*Jour. Dept. Agr. Victoria, 13* (*1915*), *No. 10, pp. 605–608, figs. 7*).—This disease was noted in portions of Australia in 1900, 1911, 1912, and 1913. The rapid progress observed during the latter years has apparently been checked recently by a protracted drought, but it is thought that the disease occurs now wherever citrus trees are grown in this region.

The life history of the fungus and the progress of the disease are described. The fungus can exist either as a saprophyte or as a wound parasite, reproducing by means of conidia or of sclerotia. Infection is favored by wet weather.

All the smaller infected branches should be cut out and all diseased material scraped from the larger branches and the stem, all the removed material being destroyed by fire and all wounds being painted with a mixture of carbolic acid and water in equal parts. A paste prepared by mixing when cool 1 lb. copper sulphate in 1 gal. water and 2 lbs. of quicklime freshly slaked in ½ gal. water, may be applied to diseased places after cleaning them thoroughly.

The same fungus has recently been found to produce injury or death in case of seedlings of *Eucalyptus citriodora* and *Jacaranda mimosæfolia*.

Citrus canker, F. A. WOLF (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 2, pp. 69–100, pls. 4, figs. 8*).—In a paper contributed from the Alabama Experiment Station, the author gives an account of an investigation of the life history of the organism *Pseudomonas citri*, the cause of the citrus canker. Infection is considered to occur through natural openings and through wounds. The rapid spread of the disease is favored by the simultaneous occurrence of newly exposed cankerous cells and the presence of a film of moisture, especially on young parts of the plant. The bacteria occur for the most part between the cells of the host and cause them to become considerably hypertrophied.

In addition to the bacteria causing this disease, fungi belonging to the genera Phoma, Fusarium, and Glœosporium have been isolated from citrus

cankers. Of these the species of Phoma alone was found to be notably active in the disintegration of the tissues. This fungus is believed to be hitherto undescribed and the name *Phoma socia* n. sp. is given it.

Some investigations are reported in which an attempt was made to determine causes for the difference in susceptibility to citrus canker of Satsuma oranges and grapefruit. As a result of these studies the author concludes that difference in susceptibility can not be accounted for on the basis of differences in the total organic acids in the two plants.

Attention is called to the failure of spray mixtures to control this disease, the successful eradication of which seems to be possible only when the work of destruction of trees is thoroughly done with the observation of proper sanitary precautions.

Panama disease of bananas (*Jour. Jamaica Agr. Soc., 18 (1914), No. 12, p. 502; Queensland Agr. Jour., n. ser., 4 (1915), No. 1, pp. 41, 42*).—Measures insisted upon to prevent the general spread of Panama disease include a rigid quarantine of infected areas and thorough disinfection of boots, tools, etc., used in connection therewith; complete destruction of diseased material; and fencing all infected areas with close-woven wire to prevent the passage of animals.

A disease of cinnamon, A. Sharples (*Agr. Bul. Fed. Malay States, 3 (1915), No. 9, p. 381*).—Individual cinnamon bushes growing in the experimental gardens at Kuala Lumpur have been dying for some time. The trouble usually begins with the death of a branch. The whole cortex is diseased, showing the presence of a fungus, *Pestalozzia palmarum*, the fruiting bodies of which are embedded therein until its disintegration frees the spores. Potato agar cultures show hyphæ in two days, and in four days the black fruiting bodies appear, showing the typical spores. Attack by this fungus is localized and can usually be controlled even when the trees are growing in unfavorable conditions. In Ceylon, *P. palmarum* causes a gray blight by its attack on the leaves, which is not so serious as the stem attack.

The most effective means of protection is the removal of all diseased portions before the spores are freed from the fruiting bodies in the rotting cortex.

The anthracnose of the mango, J. B. Rorer (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 5, pp. 164–171, pl. 1*).—Anthracnose (*Glœosporium mangiferæ* or *Colletotrichum glœosporioides*), said to be the most common and destructive of mango diseases, and attacking almost every variety wherever grown, is described as damaging the flowers, leaves, and fruit. Bordeaux mixture gave excellent results, especially with the more susceptible varieties.

A few trial shipments indicated that mangoes can be shipped successfully to distant markets in cold storage. Fruits should be full but not ripe when taken from the tree, and this should be done without injuring the fruit. The boxes for shipping and packing should be of medium size, holding about 2 doz. fruits.

A disease of mangosteen trees, W. N. C. Belgrave (*Agr. Bul. Fed. Malay States, 3 (1915), No. 6–7, p. 229*).—It is stated that mangosteen trees are liable to attack by the fungus *Zignoella garciniæ*, which causes the formation of cankers in the stems, working back from the younger to the older branches. When these have been ringed by the cankers, the foliage withers, turns brown, and dies, the death of the whole tree quickly following. In cross section, the cankers are seen to extend inward to the wood, but the latter is seldom attacked. Fructification of a species of Hendersonia, possibly another stage of Zignoella, are often found on the cankers.

The most practical measures are to cut and burn the trees which have begun to wilt, as these are doomed, and to remove the affected branches in the vicinity.

Insects and diseases affecting pinks and their treatment, J. Lochot (*Jardin, 29 (1915), Nos. 669, pp. 315, 316; 670, p. 322*).—This article, besides mentioning some insect pests of pinks, and nematodes, the control of which requires eradication of the plants attacked, discusses also a rust of pinks due to a Puccinia, which is said to yield to treatment with sulphur sprays, and a browning due to *Helminthosporium echinulatum*, for which is prescribed a 2 per cent copper spray with removal of all parts seriously affected.

Seasonal duration of ascospore expulsion of Endothia parasitica, F. D. Heald and R. A. Studhalter (*Amer. Jour. Bot., 2 (1915), No. 9, pp. 429–448, figs. 6*).—Describing the method, plan, and results of attempts to ascertain by means of traps the activity of spore expulsion by *E. parasitica*, the authors state that the expulsion begins in the spring with the first warm rains. It increases to a maximum under favoring conditions, declining under the lower temperatures of autumn, and ceasing entirely during the cooler portions of the year, even under abundant rainfall. During one-half to two-thirds of the year, there is a copious expulsion with each rain of any consequence, except when the temperature drops below the minimum, which is not far from 50 to 55° F.

Perithecial pustules of the chestnut blight fungus show a remarkable power of spore production. This is not exhausted in a single season, being sometimes as marked during the second season as the first. Apparently, also, pustules first producing mature perithecia in the fall may produce spores during the two following seasons. This is due to the fact of successive maturing of asci, successive maturing of perithecia, and successive maturing of stromata throughout the season.

A bibliography is appended.

Report of chestnut blight eradication, A. B. Brooks (*Crop Pest Com. W. Va. Bien. Rpt., 1 (1913–14), pp. 50–61, figs. 8*).—This is a brief account of work done to eradicate the chestnut blight in portions of West Virginia in 1913–14.

Fire injury to chestnut trees appears to favor greatly attack by the blight fungus. Experimentation was begun to determine to what extent the spread of blight can be checked by cutting the diseased trees and leaving them flat on the ground, based upon the observation that the spread from cankers situated low down on trees is slight as compared with that from those situated high up, especially on trees in prominent situations.

The leaf blotch of horse-chestnut, V. B. Stewart (*New York Cornell Sta. Bul. 371 (1916), pp. 411–419, pl. 1, figs. 8*).—The author gives a description of the leaf blotch of horse-chestnut and allied species due to the fungus *Guignardia æsculi*. This fungus is said to have caused considerable injury to trees, particularly those in the nursery, through the destruction of the leaf tissue. Experiments for the control of the leaf blotch have shown that lime-sulphur solution or Bordeaux mixture can be effectively employed, but considerable difficulty is experienced in their application owing to the dense foliage of the trees.

In the summer of 1915 an experiment was made on nursery trees for the control of the leaf blotch by dusting a mixture containing 90 parts of finely ground sulphur and 10 parts of powdered arsenate of lead. This treatment was found effective and is preferred, as there is little danger of injuring the foliage by burning. The dust mixture, it is claimed, can be applied more thoroughly and with greater facility than the spraying solutions, but its cost is somewhat higher than either of the solutions above mentioned.

Host plants of pink disease in Malaya, A. Sharples (*Agr. Bul. Fed. Malay States, 3 (1915), No. 5, pp. 203, 204*).—It is stated that three new hosts are to be added to the list previously published (E. S. R., 33, p. 151). Of these, *Tephrosia hookeriana* is though to have served as a center of infection in one

place where the number of cases of pink disease had increased greatly during the last year. *Indigofera arrecta* was found to be attacked by pink disease, but mildly and only in a few instances, where the host plants were not in good condition. *Clitoria cajanifolia* has also been recorded as a host for pink disease at the Buitenzorg Botanic Gardens. The form assumed by the fungus on the above plants was the pink incrustation commonly observed on rubber, on which usually, as on all these plants, no trace of basidiospores was found.

The red rot of conifers, F. H. Abbott (*Vermont Sta. Bul. 191 (1915), pp. 3–20, pls. 4, figs. 2*).—According to the author the so-called red rot of conifers is due to the fungus *Trametes pini*, which is primarily a parasite assuming more or less the character of a saprophyte when the tree falls. The fungus is said to attack tamarack, pine, hemlock, spruce, and balsam, its ravages being greatest in unthinned stands, especially in pure stands of white pine.

The infection apparently occurs mainly through broken branches which expose the heartwood, root infection being considered doubtful. The principal means of spreading the disease is through the sporophores, which are formed on all host species but vary in form on different hosts, occurring on both standing and fallen trees. The damage to the wood is brought about by the solution of its lignin content by the enzym of the fungus and this injury appears to cease when the tree falls. The damaged wood may be used in the manufacture of boxes, tubs, wooden pails, etc. For prevention of spread of the red rot, proper thinning, removing the diseased trees, and destroying the fruiting bodies are recommended.

The two rust diseases of the spruce, A. W. Borthwick and M. Wilson (*Notes Roy. Bot. Gard. Edinb., 9 (1915), No. 41, pp. 65–69, pl. 1*).—Discussing the life history of *Chrysomyxa rhododendri* causing spruce blister rust and also rust of rhododendrons, the authors state that although the presence of the spruce is apparently not essential to the continued existence of the fungus, the æcidial stage on the spruce can exist only where the rhododendron is present, as the infection of the needles is brought about only by the sporidia. Removal of the rhododendron will, therefore, completely check the disease. The effect of this disease on rhododendron is not very serious. In case of the spruce, the diseased needles fall in the summer of infection, and in severe cases, the trees may be almost stripped of their foliage.

C. abietis, the needle rust of spruce, is also discussed as to its biology and distribution. Certain spruces in a wood may be badly attacked while others remain free from the disease. This is ascribed to the fact that infection takes place in a certain definite stage in the development of the young leaves, which, in some cases, does not coincide with the exact developmental stage of the sporidia necessary to infection. While a considerable degree of defoliation may take place, the disease usually fails to maintain itself through a long series of years on any one tree, so that cutting down the trees on account of this disease is not recommended.

Honey fungus, C. Frömbling (*Forstw. Centbl., n. ser., 37 (1915), No. 7, pp. 299–304*).—This is a somewhat general summation of observations on *Agaricus melleus* regarding its activity and effects as related to some conifers in connection with such conditions as age, soil, growth, spacing, and shading by other trees.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Birds of Porto Rico, A. Wetmore (*Porto Rico Bd. Agr. Expt. Sta. Bul. 15 (1916), pp. 140, pls. 10*).—This is a reprint, text unchanged, of Bulletin 326 of this Department, previously noted (E. S. R., 34, p. 849).

Winter crow roosts, E. R. KALMBACH (*U. S. Dept. Agr. Yearbook 1915, pp. 83–100, pls. 2, fig. 1*).—This account of the roosting habit of crows, location of roosts, and estimates of the numbers that gather in certain roosts includes a list which gives the location, by States, of the crow roosts known to have been occupied in the winter of 1911–12, together with estimates of the numbers of birds in each. A discussion of the winter food of crows and their relation to seed distribution is included.

Oklahoma insect calendar, C. E. SANBORN (*Oklahoma Sta. Circ. 39 (1916), folio*).—This calendar lists 42 types of insects and gives the appearance and parts of plants affected by each type, together with the treatment or suggestions relative to control. Spraying schedules for the apple, peach, cherry, and plum and general insecticide formulas are also given.

Insect injury to cotton seedlings, B. R. COAD and R. W. HOWE (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 3, pp. 129–140, pls. 5*).—This paper reports observations made in the vicinity of Tallulah, La., during the spring of 1915, on the mutilation of the leaves of cotton seedlings by insects. It appears that this injury can be caused by any of several insects, including a number of species of lepidopterous larvæ, grasshoppers, and leaf beetles. Tussock larvæ were responsible for most of the damage early in the season and then were supplanted by grasshopper nymphs. The other insects mentioned are the "woolly bear" larvæ, or salt marsh caterpillar, and the cutworms *Prodenia ornithogalli* and *Peridroma margaritosa saucia*.

Recent grasshopper outbreaks and latest methods of controlling them, F. M. WEBSTER (*U. S. Dept. Agr. Yearbook 1915, pp. 263–272, pls. 6, figs. 3*).—This is a popular summary prepared by the author just prior to his death (E. S. R., 34, p. 200).

The terrapin scale: An important insect enemy of peach orchards, F. L. SIMANTON (*U. S. Dept. Agr. Bul. 351 (1916), pp. 96, pls. 3, figs. 20*).—The increasing abundance of the terrapin scale (*Eulecanium nigrofasciatum*) in the eastern United States, together with numerous complaints recently received from orchardists in many localities within the Appalachian peach belt of severe injury to peaches and of inability to control the pest with the materials commonly used, led to investigations during the seasons of 1912 and 1913 at a field laboratory at Mont Alto, Pa., a locality well within the limits of the badly infested area.

The terrapin scale is a native species which first came to the attention of economic entomologists in 1870, and which since 1898 has gradually assumed more and more importance as an enemy of the peach until now it is feared by the peach growers of Maryland and Pennsylvania more than any other species of scale. At present it is largely confined to the humid area of the Austral Region, considerably more than one-half of all the known infestations being found in Pennsylvania and Maryland.

In its range and importance this scale ranks easily as second among the scale pests of the peach, and while neither so prolific nor so injurious as the San José scale, it is even more of a nuisance owing to the difficulty met with in its control. The injury to the trees from loss of sap, while considerable in badly infested orchards, is small in comparison with the damage resulting from the deposit of honeydew, which on badly infested trees makes the fruit almost unsalable. While it attacks more than 30 species of plants it becomes abundant on only a comparatively few, its preference for its principal food plants being as follows: Peach, plum, maple, cherry, sycamore, and mistletoe.

A detailed report of life history studies is presented, much of which appears in tabular form and in charts. "The female of the terrapin scale reaches maturity about the first of June and gives birth to living young soon after-

wards. These are retained for a period of from one to three days in the brood chamber, which is a dome-shaped cavity beneath the scale. They then emerge and migrate at once to the underside of the leaves, where they settle, mostly along the midrib and the larger veins. The first instar, which lasts about 18 days, is vegetative and the larvæ show no sexual differentiation, but during the second instar, which also lasts about 18 days, sexual differentiation is very pronounced. At the end of this instar the female is very flat and circular, while the male, which is flat and decidedly oval, is protected by a conspicuous waxy structure called the puparium. After the second instar the sexes follow entirely different lines of development.

"The female remains for one day upon the leaves after entering the third instar, which is the final instar for this sex. During this day it secretes a thin wax scale, which protects it during the twigward migration. At the beginning of this migration the female larvæ abandon the leaves and pass to the basal part of the new growth, where they make their final attachment within the area of greatest illumination. They then commence a period of rapid growth, during the first 11 days of which they develop their mating color, which is a conspicuous red band upon the middorsal line. At the time the dorsal band is completed the male migrates to the leaves, mates, and dies. The female after mating starts a rapid growth, during which the mating colors and the larval characters are lost and during which vast quantities of honeydew are deposited. By the end of the twentieth day upon the twig the female has assumed all the adult characters. After this, growth gradually slackens until the cold of the approaching winter forces the scale into hibernation. In the spring growth is resumed. Maturity is reached early in June and the scale dies early in July, after having lived about 13 months.

"The male, which makes the second molt and passes all of its remaining instars except the last day of the imago under the protection of the puparium, loses its mouth parts at this time and lives during the remainder of its life upon nourishment taken in the first two instars. The third or prepupal instar lasts about two days and is a period of rapid metamorphosis, in which the larval organs are replaced by the adult structures. In the fourth or pupal instar, which lasts for about eight days, the adult organs reach their full development. At the fourth and final molt the imago escapes from the pupal case but remains for about two days under the puparium before emerging, when it migrates at once to the twigs, copulates, and then dies, after having lived about 49 days."

Mention is made of four attending ants, none of which benefit the scale to any extent, of several predaceous enemies, and of a number of parasites. The scale is heavily parasitized by *Coccophagus lecanii*, which was the most abundant species reared in 1912, although *C. cognatus* was also abundant, especially in the fall. In 1913 *C. lecanii* was rare, while *C. cognatus* appeared in large numbers and attacked the developing females in the spring, killing from 20 to 50 per cent of the scales. *Aphycus stomachosus* was the most abundant parasite in 1913, being more numerous than *C. cognatus*.

Remedial work conducted during the first season was directed toward the direct prevention of soot injury, which was found to be impractical. In the second season sprayings were directed against the scale, seven groups of materials being tested. The first of these groups contained corn oil, rosin oil, and gasoline, the two first named being very good treatments but injurious to the trees, while gasoline was inefficient but gave promise as a wax solvent and penetrant. The second group contained miscible oils which were found to be injurious when used in the winter at effective strengths but were used without injury when applied in the spring before the swelling and the bursting of the fruit

buds. It was found that healthy 11-year-old trees could be sprayed for three consecutive seasons with miscible oil, 1:18, without injury to the trees, and that the scale could be controlled by two seasons' sprayings with this oil. It was further found that combining gasoline emulsion and miscible oil added to the efficiency of the oil. The greatest efficiency was obtained when 5 parts of miscible oil were added to 2 parts of gasoline (emulsified) and 92 parts of water. The third group consisted of ten experiments made with cotton-seed oil and combinations with gasoline. The highest efficiency was obtained by using an emulsion containing cotton-seed oil 5 gal., gasoline 3 gal., soap 2 lbs., and water 92 gal. The fourth group consisting of five experiments made with raw linseed oil gave promising results, the oil being very efficient alone as a 10 per cent emulsion and even more so when combined with gasoline. The gasoline component increases the fluidity of the oil, dissolves the protecting wax film, and tends to asphyxiate the scales. The best results were obtained by using an emulsion made up of raw linseed oil 5 gal., gasoline 3 gal., laundry soap 2 lbs., and water 92 gal. This emulsion applied in the spring before the buds burst will control the terrapin scale at a single application, at a cost for material of from 1 to 8 cts. per tree. This was found to be the most effective treatment of any of the remedies tried against this insect. Group 5, consisting of two experiments with mixed oils, showed no advantages in mixing linseed and cotton-seed oils. In group 6 nicotin was tested in 14 experiments, proving this substance to be inefficient. Group 7, consisting of 20 experiments with various coating sprays, gave ineffective results.

In making recommendations for control the author advises the application of the linseed-gasoline emulsion above mentioned, applied in the spring before the buds burst. In order to protect the crop after the trees are in foliage, it is recommended that an application be made, just before the leafward migration, of the formula consisting of flour (in paste) 10 lbs., stone lime 15 lbs., sulphur 20 lbs., and water to make 50 gal.

A 4-page bibliography is included.

The alfalfa webworm, C. E. Sanborn (*Oklahoma Sta. Bul. 109* (*1916*), *pp. 3–7, figs. 4*).—*Loxostege similalis*, which occurs throughout the United States and in South America, passes the winter in Oklahoma in the pupal stage. The adults emerge from these pupal forms and appear about the middle of April. The second generation appears about May 25, the third from June 28 to July 16, the fourth from July 27 to August 2, the fifth about September 16, and adult forms are present as late as November. The adults deposit eggs in masses, generally on the lower side of the leaves of their food plants, each mass containing from 5 to 42 eggs, or an average of 19, which hatch ordinarily within three or four days. The larvæ or webworms develop in about three weeks, and the pupal period during summer is ordinarily seven or eight days, but in hibernation extends from about the middle of October to the middle of April.

All broods, except the last or fall brood, are characterized by their web-spinning habit. While the "careless" or pigweed is its natural food plant, it feeds on practically all the common weeds, except the jimson weed and devil's claw. The methods of control mentioned are mowing infested fields, poisoning fields, renovation, clean culture, and jarring cultivated plants such as corn and cotton.

A list of 21 references is appended.

A general survey of the May beetles (Phyllophaga) of Illinois, S. A. Forbes (*Illinois Sta. Bul. 186* (*1916*), *pp. 215–257, fig. 1*).—The data here presented relate to a study of the number of species and specimens, dates of occurrence, food plants, and distribution in Illinois of nearly 119,000 May beetles or June

bugs, belonging to 34 species of the genus Phyllophaga and collected in 42 counties from 1905 to 1911, inclusive, and in 1913.

"Thirty-four species of May beetles are recognized in Illinois. They vary greatly in abundance, the above collection containing but two specimens of the rarest species and 43,349 of the commonest. Ninety-one per cent of the specimens collected belonged to 10 of the species, the other 9 per cent being distributed among the 24 species remaining.

"A detailed discussion of the species, taken separately, shows for each its numbers in each year and in each of the three sections of the State, the dates in each year of its first appearance and its greatest abundance, and its comparative numbers on each of its food plants. By means of the data of numbers and distribution, the dominant and subdominant species are distinguished for each year and district, and the intervals between their periods of greatest abundance are considered with reference to the length of the life cycle of the species concerned.

"From a comparison of the May beetles derived from northern, central, and southern Illinois, respectively, it appears that three species are practically limited to northern Illinois, three to the northern and central parts of the State, two to the central and southern, and 11 to southern Illinois. The actual boundary lines between these areas of distribution are, however, irregular and meandering, especially that between southern and central Illinois, which is influenced by the course of the streams, the southern species following them northward toward their headwaters in a way to bring several such species far into the central division of the State.

"The seasonal succession of the species—that is, the order in which they make their first appearance in spring—is worked out for each section of the State as carefully as the wide distribution and irregular time limits of the collections will permit.

"Generally speaking, successive periods of extraordinary abundance of a species in any locality or district show little correspondence to any possible life cycle, being too various and irregular for that interpretation. Extensive parasitism of imagos and larvæ by insects, annelids, Protozoa, and fungi produces widespread and destructive epidemic diseases, a knowledge of whose prevalence and status is essential to any safe prediction of periods of destructive abundance of the white grubs.

"The May beetle species known as *Phyllophaga fusca* and *P. futilis* were evidently those which produced most of the white grubs which were so abundant in northern Illinois in 1912 as to do heavy damage to farm crops in several counties. Two-thirds of the collections made in that section in 1914 were of these species, the first of the two mentioned being, however, nearly four times as abundant as the second.

"The facts concerning the food plants of the more abundant species are grouped and classified in a way to distinguish trees and shrubs especially attractive to them, and consequently dangerous to adjacent crops by reason of the abundance of white grubs to descend from them."

The influence of trees and crops on injury by white grubs, S. A. FORBES (*Illinois Sta. Bul. 187 (1916), pp. 261–265*).—The natural supposition that fields nearest to the food plants of May beetles, that is trees, must become most heavily stocked with eggs and consequently worst injured by grubs when these eggs are hatched led the author in 1904 to commence the collection of information bearing on the subject.

Collections were made of white grubs in fields that were being plowed in the fall or spring by walking behind the plowman and making note of the

distance traveled in each field and the number of grubs exposed by the plow, and recording at the same time the distance from the field to the nearest trees upon which the May beetles might be supposed to have fed. Observations and collections of this nature were made by six field assistants during 1904, 1905, 1907, and 1908 in 549 fields widely scattered throughout central Illinois, and in a few fields also in the northern and southern parts of the State. The total distance traveled was over 429 miles, a total of 12,069 grubs of the genus Phyllophaga and 1,187 of the genus Cyclocephala being collected.

For the purpose of classification all of the data thus obtained were assorted into four groups, according to the distance of the fields from the nearest trees. In group 1, in which 224 miles were traveled in fields with trees within or on their borders or within less than one-eighth of a mile, white grubs of the genus Phyllophaga were found at an average rate of 39.17 to the mile. In group 2, 40 miles were traveled in fields with trees more than one-eighth but less than one-fourth of a mile away, and in these Phyllophaga grubs averaged 17.83 to the mile. In group 3, in fields with trees more than one-quarter of a mile away and less than one-half mile, 130 miles were traveled and Phyllophaga grubs averaged 15.94 to the mile. In group 4, in fields with trees half a mile away or more, 35 miles were traveled and 14.4 was found as the average number of Phyllophaga grubs.

In a study of the data bearing on the kind of crops in which May beetles prefer to lay their eggs, it was found "that more eggs were laid in pastures (84 grubs per mile) than in any other crop; that small grain came next with 61 and 62 per mile for fields which had been in oats and wheat, respectively; that fallow land, grown up of course to weeds, largely grasses, was third, with 48 grubs to the mile; that clover and corn seemed not far apart in attractiveness to the egg-laying beetles—clover with 30 and corn with 25 grubs to the mile; and that meadow crops (excluding clover) were least sought by the egg-laying beetles—about 15 grubs to the mile in fields which had been in such crops when the eggs were laid. . . . The evidence of the predominance of grasses and small grains over corn and other crops as a lure to May beetles about to lay their eggs is unmistakable here, and much more emphatic than that obtained from our general collections behind the plow."

Studies of the Mexican cotton-boll weevil in the Mississippi Valley, R. W. Howe (*U. S. Dept. Agr. Bul. 358 (1916), pp. 32, figs. 2*).—This is a report of studies carried on during 1913, 1914, and 1915, largely at the Delta Boll Weevil Laboratory at Tallulah, La., with a view to determining what influence new climatic and environmental conditions have upon the biology of the boll weevil. The work has been summarized by the author as follows:

"In northern Louisiana the average longevity of the boll weevil adults on cotton squares was 54.56 days, on bolls 31.41 days, on cotton leaves 8.17, and on okra fruit 5.4, the average for these different classes of foods being 14.13 days. The females live somewhat longer than the males, there being an average of 12.5 days for females and 9.82 for males.

"A number of weevils were found feeding in okra blooms in the field, but attempts to cause them to breed in okra fruit in the laboratory were unsuccessful. A number of eggs were deposited, but they failed to hatch.

"The largest number of eggs deposited by the first generation weevils was 204, the average being 132. The daily maximum varied from 5 to 12. Second generation weevils showed somewhat less fecundity, the maximum oviposition being 175 eggs and the average 69.4. The average period of oviposition was 38.2 days, the range being 1 to 77 days. The greatest activity of the weevil in depositing eggs was found to be between the hours of 9 a. m. and 1 p. m., but

certain numbers of eggs were deposited at all times of the day and during the night. The average period from oviposition to the emergence of the adult was practically 14 days for each of the five generations.

"Seven complete generations were developed at Tallulah during the season."

Boll weevil in Alabama, W. E. HINDS (*Alabama Col. Sta. Bul. 188* (*1916*), *pp. 23–64*, *pls. 4*, *figs. 3*).—This general account deals with the spread of the boll weevil in Alabama, describes and illustrates the stages and work of the weevil, and discusses the means of spread, propagation, hibernation, and control measures.

Oviposition of Megastigmus spermotrophus in the seed of Douglas fir, J. M. MILLER (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 2*, *pp. 65–68*, *pls. 3*).—This account of the oviposition of the seed chalcidid *M. spermotrophus* is based upon observations made at the Forest Insect Station of the Bureau of Entomology of this Department at Ashland, Oreg., largely during the season of 1915.

During the season of 1914 male adults began to emerge on April 12 and the females on April 16 from stored Douglas fir seed kept in a rearing box; 2,897 adults emerged from 6.75 oz. of seed, the period of maximum emergence occurring between April 23 and May 11. In 1915 the maximum period of emergence in the laboratory occurred between April 20 and May 2. From cones which were kept caged over winter under outdoor conditions at the same elevation, the maximum emergence occurred between May 1 and 16. At elevations of 3,000 to 4,000 ft., the emergence occurred during the latter part of May, and above 4,000 ft. much of the emergence occurred in June.

The oviposition of two females was recorded on April 22 and that of the same number on April 23, and females were observed ovipositing from this time up until May 5. From two to five minutes were required for oviposition, the same female having been observed to oviposit five times on the same cone. Actual oviposition in the field was observed only once and that on May 28, by J. E. Patterson.

Life history and habits of two new nematodes parasitic on insects, J. H. MERRILL and A. L. FORD (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 3*, *pp. 115–127*, *figs. 3*).—Two new nematodes have been observed at the Kansas Experiment Station, one parasitic on the elm borer and the other on the termite *Leucotermes lucifugus*. When 121 beetles obtained from a single elm tree were kept in breeding cages in no instance were eggs deposited and both sexes eventually weakened and died, examinations showing death to have been due to nematode parasitization. Several colonies of *L. lucifugus* were examined and 76.92 per cent found parasitized by nematodes.

Specimens of these nematodes were submitted to N. A. Cobb of this Department, who describes the species which parasitized the elm borer under the name *Diplogaster labita* n. sp., and that of the termite under the name *D. aerivora*, n. sp.

"The eggs of *D. labiata* hatched in from 30 to 32 hours, while those of *D. aerivora* hatched in about 18 hours. The eggs of *D. labiata* were deposited singly, while those of *D. aerivora* were deposited in groups. More cases of eggs hatching in the body were found in *D. aerivora* than in *D. labiata*. The eggs of both species developed similarly.

"Both species, when reared in water cultures, used the same food, but in nature they had different hosts. Both species molted, but the process differed in that *D. labiata* fastened its posterior end, while *D. aerivora* did not. The adults of *D. aerivora* were larger than those of *D. labiata* and required much less time to mature. In water cultures the females of both species were more

numerous than the males. Although mating was similar in both species, *D. labiata* required more time for the process. Individuals of *D. labiata* usually mated but once, while those of *D. aerivora* mated repeatedly. Neither species in their habits showed any preference to day or night. The females of *D. aerivora* had a period of oviposition of about 13 days, while in *D. labiata* this period lasted only about two days.

"In both species adaptable and plentiful food acted as a stimulant to reproduction. Both species attacked insects, but in different regions of the body, as *D. aerivora* was found in the head while *D. labiata* was found in the intestines. The life cycle of *D. labiata* required more than twice as much time as did that of *D. aerivora*. *D. aerivora* was successfully introduced into the termites."

FOODS—HUMAN NUTRITION.

[Progress in] physiological chemistry [during 1915], F. G. Hopkins (*Ann. Rpts. Prog. Chem. [London], 12 (1915), pp. 187–209*).—The author reviews and discusses important contributions by a number of investigators to the knowledge of various phases of physiological chemistry, including general metabolism (especially the basal metabolism of men and women, the surface law, and the specific dynamic action of food); the chemistry of proteins (especially some aspects of protein metabolism); carbohydrate and fat metabolism; growth-stimulating substances; and internal secretions. The bulk of the material has been noted from the original sources.

Shipping fish 3,000 miles to market, E. D. Clark (*U. S. Dept. Agr. Yearbook 1915, pp. 155–158, pls. 3*).—Information is given regarding the methods of handling, storing, and shipping halibut and salmon from the Pacific coast to markets all over the country.

An outbreak of typhoid attributed to infected oysters, P. B. Brooks (*Jour. Amer. Med. Assoc., 66 (1916), No. 19, pp. 1445–1447*).—About 50 cases of typhoid fever in the city of Binghamton, N. Y., and near-by municipalities were apparently traced to oysters supplied by two wholesale dealers.

The baking qualities of different varieties of wheat, O. Rammstedt (*Ztschr. Öffentl. Chem., 21 (1915), Nos. 20, pp. 306–312; 21, pp. 321–329; 22, pp. 337–345*).—Analytical data and the results of baking tests are reported, showing the relationship between the chemical composition of several different grades of wheat and the volume of the resulting loaf.

Nutritive value of wheat flour and bread in relation to phosphorus content, G. Masoni (*Staz. Sper. Agr. Ital., 48 (1915), No. 5–7, pp. 385–456*).—A large amount of analytical data is given showing the phosphorus content of different grades of wheat flour and the resulting bread. In general it is indicated that the percentage of mineral substances, organic phosphorus, and ether extract increases from flour to bran. Practically the same amounts of phytin and nuclein occur in the bread as in the flour, but, probably owing to the low temperature at which it is decomposed, lecithin occurs in lesser amounts in bread.

The author concludes that the coarser flours have a greater nutritive value than the finer and whiter flours, since they contain larger percentages of phosphorus and nitrogenous compounds, complex mineral substances, and crude fat.

A bibliography is appended.

Does light influence the staling of bread? J. R. Katz (*Hoppe-Seyler's Ztschr. Physiol. Chem., 96 (1916), No. 4–5, pp. 288–291*).—From a comparative examination of samples of bread kept in a dark room and exposed to both

direct and diffused sunlight, the author concludes that light does not influence the staling of bread.

Previous studies of the staling of bread have been noted (E. S. R., 34, p. 858).

The noteworthy property of aldehydes in retarding the staling of bread, J. R. KATZ (*Hoppe-Seyler's Ztschr. Physiol. Chem., 96 (1916), No. 4–5, pp. 314–322*).—Experimental data are reported regarding the influence of aldehydes and ketones on the staling of bread. It was found that aldehydes act on the starch granules, thereby keeping bread fresh for an exceptionally long time. Ketones did not possess this property.

Bread making and butyric ferment in Latium, R. PEROTTI and U. CRISTOFOLETTI (*Staz. Sper. Agr. Ital., 48 (1915), No. 5–7, pp. 361–384*).—The authors report a study of the ordinary leaven of Velletri bread, from which *Clostridium butyrium* and *Saccharomyces minor* were isolated. The good qualities of this bread are considered to be due largely to butyric fermentation.

Seaweed as a supplementary food material, E. BECKMANN (*Abs. in Zentbl. Biochem. u. Biophys., 18 (1915), No. 11, p. 379*).—Feeding experiments are described in which laboratory animals (dogs and hens) were given bread made from mixtures of finely ground seaweed and wheat, rye, and potato flours. During baking the characteristic odor disappeared, and the bread was found to possess good properties. Analytical data are given.

The effects of commercial glucose when fed to white rats, A. J. CARLSON, L. HEKTOEN, and E. R. LECOUNT (*Jour. Amer. Chem. Soc., 38 (1916), No. 4, pp. 930–936, fig. 1*).—The experiments here reported cover a period of six months, and were carried out to study the general effects of commercial glucose when consumed regularly in considerable quantities. Laboratory animals (white rats) were fed upon bread containing the glucose. As controls, other rats were fed on bread containing granulated cane sugar and others on bread without sugar or glucose. The bread was unleavened and consisted of flour, 1,000 parts; lard, 25 parts; baking soda, 15 parts; hydrochloric acid, enough to neutralize the soda; water as required for the flour, about 655 parts; commercial glucose, 34 parts, in the case of "glucose bread," and granulated cane sugar, 26.5 parts, in the case of "cane sugar bread." The results of the experiments are discussed somewhat at length and the following conclusions are drawn:

"The addition of commercial glucose in the amounts of about 2.5 gm. to 3.5 gm. per kilo of body weight per day to the diet of white rats for a period of six months has no abnormal influence on the animals, either favorable or unfavorable, as determined by the rate of growth fecundity, immunity reactions, and the condition of the organs.

"As both the glucose-fed and the control groups of rats were kept on a liberal diet throughout the observation period, the experiment does not show to what extent the commercial glucose was actually absorbed and oxidized, but in the quantities fed the commercial glucose certainly has no injurious effects."

Gelatin as a food for the people, E. HOMBERGER (*Sci. Amer. Sup., 81 (1916), No. 2097, p. 167*).—Historical data are given regarding the use and food value of gelatin and the work of recent investigators is summarized briefly. It is stated that gelatin is dissolved very quickly and completely in the cells and by its solution saves the albumin from solution. This quality of saving the albumin is twice as great as that of fats or carbohydrates.

"If, besides gelatin, a certain amount of albumin is supplied to the body, and a certain amount of fats and carbohydrates to prevent the loss of fat, the normal condition of the body can be maintained."

A ferment in water which produces the dehydration of glycerin, E. VOISENET (*Ann. Inst. Pasteur, 28 (1914), No. 8, pp. 807–818, figs. 2*).—Studies

are reported of an organism thought to be identical with *Bacillus amaracrylus*, which is sometimes contained in water and which is able to dehydrate glycerin with the formation of acrolein.

Chemical determination of the nutritive value of wood and straw, E. BECKMANN (*Abs. in Zentbl. Biochem. u. Biophys., 18 (1915), No. 11, p. 379*).—Chemical analyses are reported indicating the following percentages of starch in different kinds of wood cut during the autumn: Birch, 0.95; alder, 1.54; maple, 2.65; and elm, 5.9. In the spring of the year the birch was found to contain 3.67 per cent of starch and 2.44 per cent of ether extract. The amount of ether extract contained in the woods during the autumn varied from 0.37 to 1.35 per cent.

The bacteria in ice cream, W. M. ESTEN and CHRISTIE J. MASON (*Connecticut Storrs Sta. Bul. 83 (1915), pp. 128–134, fig. 1*).—This investigation was made to determine the effect of storing frozen ice cream on the numbers and kinds of bacteria present. Different grades of cream were used in order to determine the effect of a low or a high initial content of bacteria on the bacterial content of the resulting product. Examinations were generally made of the cream before and after mixing it with the ingredients and of the product just after freezing, and then at intervals of twice a week for a month. Ordinary household methods of freezing were used and the cream was packed in quart bricks which were wrapped in paper, enclosed in pasteboard boxes, and packed in an ice-salt mixture, the latter being renewed as often as necessary to keep the cream solid. No exact temperature measurements were kept. Plate cultures were made of litmus lactose gelatin and these were incubated at 21° C. for seven days and then counted. A table is given which shows the total number of bacteria present, the number of acid-forming organisms, and the number of liquefying bacteria present in the different samples examined.

A few samples of ice cream purchased at retail stores in pint paraffin paper carriers were packed in ice and salt and kept for two or three days before bacteriological examinations were made by the methods used in the above tests. The results of the examinations of the retail samples are reported in tabular form and correspond closely to the results obtained by other investigators in various studies.

The authors conclude that "when ice cream is kept frozen for periods of at least a month there is no marked increase or decrease in the bacterial content as shown by litmus lactose gelatin plate cultures. The percentages of acid bacteria and of liquefying bacteria also remained fairly constant. The source of most of the bacteria is the cream used."

Tomato ketchups, C. H. LAWALL and L. FORMAN (*Penn. Dept. Agr. Bul. 272 (1915), pp. 30*).—This bulletin reports the results of the chemical analysis of 142 samples of tomato ketchups and compares them with a similar investigation made in 1904.

The authors state that great improvement has occurred in the quality of tomato ketchups on the market in the matter of the use of chemical preservatives. The use of artificial coloration has entirely disappeared, and there is no basis in fact for the allegation of the use of injurious amounts of acids and spices in brands containing no sodium benzoate. Information on the 142 samples examined showed no use of unsound materials. Less than 2 per cent of them were illegal, and saccharin was not found to be present in any of those examined.

[Food and drug inspection], R. B. FITZ-RANDOLPH and W. G. TICE (*Ann. Rpt. Bd. Health N. J., 38 (1914), pp. 133–183, pl. 1*).—The food and drug inspection work of the board during the year ended October 31, 1914, is reported. In

addition to general information regarding the scope of the work, detailed statements are made of the inspection of slaughterhouses, cold-storage plants, canning factories, etc. During the year 6,180 samples of foods and drugs were examined, of which 16.3 per cent were found to be below the legal standard.

An extended report is given of the work done in the sanitary inspection of the shellfish industry of the State.

The use of box rations by the French troops, E. MAUREL (*Bul. Acad. Med. [Paris], 75 (1916), No. 9, pp. 254–259*).—Box rations for army use are suggested which contain a mixture of meat and either fresh or dried vegetables chopped in small pieces. It is intended that each box shall furnish about 30 gm. of protein and 500 calories of energy and that each man shall receive 4 of these boxes, the total weight of which shall not exceed 1 kg. To complete the ration, it is recommended that the men receive 1,200 gm. of bread, 0.5 liter of wine, and 100 gm, of dried fruit (preferably figs) every two days. The total energy value of this ration is 3,000 calories daily.

The chemistry of cow's milk and other products used in infant feeding, F. W. HOWE (*Arch. Ped., 33 (1916), No. 1, pp. 1–12*).—A compilation of data showing the composition of milk as affected by a number of different factors, and also the nature and composition of other products (protein milk, whey, etc.) used in infant feeding.

The digestibility of the proteins of milk and their rôle in infant nutrition, L. E. HOLT (*Arch. Ped., 33 (1916), No. 1, pp. 13–19, fig. 1*).—The protein need of infants is considered in the light of recent investigations and clinical experience. The author states that "the digestion of the protein of cow's milk is a much easier matter than was formerly supposed; that while injury may without question be done by high protein feeding, this is very unlikely to occur, unless amounts much in excess of those commonly used in infant feeding are administered; that in such amounts we have as yet neither clinical nor laboratory evidence to show that protein is harmful; that although an infant receiving breast-milk takes rather less than 7 per cent of his calories as protein, this can not be taken as an exact criterion of how much protein should be administered when cow's milk is the food; [and] that the deficiency of cow's milk casein in certain essential amino acids may be made up by giving an excess of this protein."

Present opinion as to the rôle of fat in infant feeding, J. L. MORSE (*Arch. Ped., 33 (1916), No. 1, pp. 20–24*).—A summary and digest of data.

A brief résumé of the rôle of carbohydrates in infant feeding, H. R. MIXSELL (*Arch. Ped., 33 (1916), No. 1, pp. 31–36*).—A summary and digest of data.

The rôle of salts in infant feeding, F. H. BARTLETT (*Arch. Ped., 33 (1916), No. 1, pp. 25–30*).—This lecture brings together the results of recent investigations of mineral elements in infant metabolism. Especial attention is given to their relation to the low iron content of cow's and woman's milk; to rickets; to gain in body weight; and to the metabolism of protein, carbohydrate, and fats.

Protein metabolism, J. J. R. MACLEOD (*Jour. Lab. and Clin. Med., 1 (1915), No. 2, pp. 112–119*).—A summary and digest of data with relation to the utilization of free amino acids.

Recuperation.—Nitrogen metabolism of a man when ingesting successively a nonprotein and normal diet after a 7-day fast, F. D. ZEMAN, J. KOHN, and P. E. HOWE (*Amer. Jour. Physiol., 36 (1915), No. 4, Proc. Amer. Physiol. Soc., 27 (1914), pp. 362, 363*).—In these experiments the authors determined the urinary nitrogen compounds and changes in body weight occurring after a fast in a 4-day recuperation period on a non-protein diet, and in a 4-day final period on a normal diet.

An increase in body weight accompanied by a loss of nitrogen occurred during the nonprotein feeding period, while the reverse was true in the final period.

The initial increase in weight after the fast is thought to have resulted from the retention of water and non-nitrogenous food substances.

What is a vitamin? (*Jour. Amer. Med. Assoc., 66 (1916), No. 19, p. 1470*).—The work of a number of investigators on this subject is discussed briefly.

Fat assimilation, W. R. BLOOR (*Jour. Biol. Chem., 24 (1916), No. 4, pp. 447–460*).—In continuation of previous investigations (E. S. R., 34, pp. 562, 563), feeding experiments with laboratory animals (dogs) are reported, in which determinations of total fat, lecithin, and cholesterol were made in whole blood and plasma during the periods of fat absorption. The results of the experiments are summarized as follows:

"Total fatty acids increase in both plasma and corpuscles but the increase is generally more marked in the corpuscles. Lecithin increases greatly in the corpuscles but only slightly in the plasma. No definite changes in the quantity of cholesterol were noted. A fairly constant relationship between total fatty acids and lecithin was noted in whole blood and corpuscles."

It is concluded that "the blood corpuscles take up the fat from the plasma and transform it into lecithin; that most if not all of the absorbed fat is so transformed; and, therefore, that lecithin is an intermediate step in the metabolism of the fats."

Goat's milk to get test (*Mod. Hosp., 6 (1916), No. 3, pp. 232, 233*).—Announcement is made of an investigation to be conducted at a New York hospital to determine the value of goat's milk for tuberculosis patients.

It is stated that although goats are particularly immune to tuberculosis and while tubercle bacilli have never been found in the milk, it has not yet been determined whether goat's milk carries with it any protection against tuberculosis. Use has been made of the milk for some time in treating summer diseases of children, and in this respect also the cause of its efficacy is unknown. Analyses have shown that the milk contains about 6 per cent of milk fat, and some investigators have thought that the small size of the fat globule may be the reason for tolerance for the milk in cases of summer complaint.

The dietary factors operating in the production of polyneuritis, E. V. MCCOLLUM and CORNELIA KENNEDY (*Jour. Biol. Chem., 24 (1916), No. 4, pp. 491–502*).—In this investigation the authors studied the relation to polyneuritis of two classes of unknown substances concerned in inducing growth—fat-soluble A, which is soluble in fat and is contained in certain fats, and water-soluble B, which is soluble in water and alcohol and is widely distributed in the animal and vegetable world. By means of experiments with birds the effects of feeding a number of substances were studied. Among them were polished rice with butter fat and with the alcoholic extracts of fat-free wheat embryo; potato juice; cabbage juice; oat extract; and the acetone, benzene, and ethyl acetate extracts of fat-free wheat embryo.

From these experiments the authors concluded that "judging from the appearance of serious nutritional disturbances ending in death which result from a shortage of the fat-soluble A, and the emaciation, weakness, and death which follow restriction to a diet inadequate in its content of the water-soluble B, it seems certain that both these classes of unknown dietary constituents are essential for maintenance as well as for growth. . . .

"In the production of polyneuritis in birds by exclusive rice feeding or exclusive feeding of a ration made up of purified foodstuffs, the degeneration of the nerve cells is the specific result of a lack of the water-soluble B. The fat-soluble A appears to be dispensable, when maintenance alone is involved, for a somewhat longer period than is the factor B."

This last assertion is based upon the fact that polyneuritis in pigeons could be produced by feeding a diet free from both the essential factors A and B, but

the birds could be completely cured and maintained in a normal condition for at least 35 days on this same diet by the addition of the water extract of a foodstuff (rolled oats) on which rats can not grow without the addition of butter fat. Other confirmatory evidence is the success obtained in inducing relief from polyneuritis in birds by treatment with lipoid-free water extract of wheat embryo and with such substances as cabbage or potato juice, both of which are practically free from lipoids.

Researches on deficiency diseases.—Experimental beri-beri produced by exclusive feeding of either decorticated or sterilized barley, E. WEILL and G. MOURIQUAND (*Compt. Rend. Soc. Biol. [Paris], 78 (1915), No. 19, pp. 649–651*).—Experimental beri-beri was produced in pigeons by feeding either decorticated or sterilized barley.

ANIMAL PRODUCTION.

Text-book of animal production, G. PUSCH, edited by J. HANSEN (*Lehrbuch der Allgemeinen Tierzucht. Stuttgart: Ferdinand Enke, 1915, 3. ed., rev. and enl., pp. XXII+547, figs. 222*).—This is the third edition of this work, revised and enlarged (E. S. R., 26, p. 573).

The behavior of the accessory chromosomes and of the chromatoid body in the spermatogenesis of the rabbit, L. J. BACHHUBER (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 30 (1916), No. 4, pp. 294–310, pls. 3*).—The author finds from his studies with rabbits that the number of chromosomes in the spermatogonium is probably twenty-two. The number in the primary spermatocytes is placed at twelve and in the secondary spermatocytes at eleven. Two accessory elements, an X and a Y, are present, one-half of the spermatozoa containing the X and the other half the Y element. A chromatoid body is present, but its function was undetermined. It underwent no division and was finally cast off with the excess cytoplasm in the metamorphosing spermatid.

Improvement and management of native pastures in the West, J. T. JARDINE (*U. S. Dept. Agr. Yearbook 1915, pp. 299–310, pls. 4*).—The author reviews the work of the Forest Service in improving the native pasture lands on the National Forests and gives suggestions for improving and managing native pastures, based on the principle of the "deferred" system of grazing, previously referred to (E. S. R., 32, p. 227).

The rate of liberation of hydrocyanic acid from commercial kinds of linseed, S. H. COLLINS and H. BLAIR (*Chem. News, 111 (1915), No. 2876, pp. 19, 20*).—Analyses of a large number of samples of flaxseed show that seeds of oriental origin and from dry, hot climates are all high in total hydrocyanic acid and rich in enzymic activity. The result of changing seed from dry, hot climates to damp and cool conditions is to reduce the amount of hydrocyanic acid evolved by 20 ± 3 per cent and the rate of evolution by 24 ± 5 per cent. Thus it appears that seed grown in temperate climates is a safer cattle feed than that from hotter climates. There is a tendency for seeds originated in temperate climates to give the best yield per acre and to contain the least proportions of cyanogenetic glucosids.

Seaweed as a supplementary feeding material, E. BECKMAN (*Sitzber. K. Preuss. Akad. Wiss., 1915, XL, p. 645; abs. in Hyg. Rundschau, 26 (1916), No. 3, p. 85*).—An analysis of seaweed is given as follows: Protein from 5 to 6 per cent; fat from 0.9 to 2.2; starch from 8.4 to 13.9; crude fiber from 5.4 to 6.4; ash from 18.3 to 23.4; and potassium chlorid from 2.5 to 6.3 per cent. The material is found desirable as a supplementary feed for poultry, growing swine and horses.

Food value of brewers' grains, residue, and yeast, W. VÖLTZ, N. MUHR, A. BAUMANN, and W. DRAUZBURG (*Landw. Jahrb., 47 (1914), No. 5, pp. 639–671*).—In feeding experiments with sheep it was found that brewers' grains containing 90 per cent of dry matter contained 8.5 per cent of digestible protein, 30.4 per cent of digestible nitrogen-free extract, a starch value of 24.8 per cent, and a physiological utility value estimated at 30 per cent of the total energy content. The brewery residue contained 26.7 per cent of digestible protein, 22.4 per cent of digestible nitrogen-free extract, a starch value of 38.7 per cent, and a physiological utility value of 40 per cent of the total energy value. With swine the brewery residue contained 25 per cent of digestible protein and 29.5 per cent of digestible nitrogen-free extract.

Cooperative live stock shipping associations, S. W. DOTY and L. D. HALL (*U. S. Dept. Agr., Farmers' Bul. 718 (1916), pp. 16, figs. 3*).—This publication treats of the origin and extent of the cooperative live stock shipping association movement, the advantages of such associations, and the method of organization.

It is stated that wherever these associations have been formed an appreciable saving to the farmer has resulted. "The profit that formerly went to the local shipper now goes to the farmer, and he has the satisfaction of knowing that he will receive for his stock the actual market price, less the cost of marketing. Moreover, the activities of a competent manager and the influence of a successful association make for a general improvement in methods of marketing live stock and a better knowledge of market prices and conditions by farmers in the entire community."

Investigation on raising beef cattle, B. O. SEVERSON (*Pennsylvania Sta. Bul. 138 (1916), pp. 3–20, figs. 8*).—This bulletin gives the average results of three years' investigations, the first two of which have been previously reported (E. S. R., 34, p. 171). The objects of the investigation were to determine the possibilities of raising beef cattle in Pennsylvania; whether the demand for "feeders" could be met profitably; the cost of maintaining breeding stock; the cost of raising growing and breeding beef cattle; the cost of finishing beef cattle for market; the value of silage as a sole roughage, and of cotton-seed meal as a supplementary feed; and, finally, to study details of management in the feeding and breeding of beef cattle for profitable production.

Ten Shorthorns composed lot 1 and 10 Aberdeen-Angus lot 2. During the summer months the breeding cows and growing stock were on pasture with no extra feed in the form of grain or roughage. During the winter months corn silage was the sole roughage fed to the breeding and growing stock. Cotton-seed meal was fed, in addition, at the rate of 1 lb. per cow daily, and at the rate of 3 lbs. per 1,000 lbs. live weight, daily, to the growing stock. The fattening stock was fed in accordance with methods proved by experiment to be profitable. The calves ran with their dams and were weaned at from 7 to 11 months of age.

In these three years' experiments the cows were maintained in good condition of flesh, and the weaned calves made satisfactory gains. The normal calves in both lots were vigorous at birth. There was no distinction between the Shorthorn and Aberdeen-Angus breeds in the utilization of feeds, cost of maintenance, or breeding qualities.

The corn silage consumed by each cow during the winter was 9,101 lbs. in lot 1 and 8,920 lbs. in lot 2. Each breeding cow required 1,090 lbs. of straw for bedding, and produced 9,785 lbs. of manure during the winter period. The value of the manure more than paid for the cost of the labor and bedding required.

The cost of wintering cows during an average winter period of 154.6 days under the conditions of this investigation was more than twice the cost of pas-

turing them for 210.3 days. The total cost of maintaining a beef cow in the Shorthorn lot was $33.54, and in the Aberdeen-Angus lot, $34.11.

The breeding results of the experiment indicated that the most important single factor for success in profitable beef production was regularity of the cows in producing calves. Under the conditions of the experiment, 70 per cent calves cost $49.73 and had a market value of $50.40, while 80 per cent calves were produced at 6.1 cts. per pound.

The period of gestation was 285 days in both lots. In lot 1 the calves averaged 75.27 lbs. at birth and 671.6 lbs. at twelve months of age, while the heifers at twenty-four months of age averaged 991.6 lbs. In lot 2 the calves averaged 68.36 lbs. at birth and 588.8 lbs. at twelve months, while the heifers at twenty-four months of age averaged 965 lbs. The number of services per pregnancy in lot 1 was 1.63 times and in lot 2, 1.43 times.

Heifers at thirty months of age for breeding purposes cost less than their market value as beef. The steers were of better grade than steers purchased for feeding purposes by the college in the fall of 1913 and costing 7.45 cts. per pound when placed in the feed lot.

The investigation indicates that beef production can be made profitable under present Pennsylvania conditions where the breeding herd is maintained largely on roughage during the winter and on pasture during the summer, when cattle of insured beef type are used, and when more than 70 per cent calves are raised annually.

Shorthorn cattle, A. H. SANDERS (*Chicago: Sanders Publishing Co., 1916, pp. 840, pls. 61, figs. 3*).—This book is a very comprehensive treatise on the origin and development of the Shorthorn breed of cattle, and their introduction, progress, and future in the United States.

Twinning in cattle, with special reference to the free martin, L. J. COLE (*Abs. in Science, n. ser., 43 (1916), No. 1101, pp. 177, 178*).—A study of 303 multiple births in cattle showed 43 cases as homosexual male, 165 cases recorded as heterosexual (male and female), 88 cases as homosexual female, and 7 cases of triplets, a ratio of twins of approximately 1 : 4 : 2, instead of the expected 1 : 2 : 1. The expectation is brought more nearly into harmony with the facts by assuming that in addition to ordinary fraternal (dizygotic) twins, there are numbers of "identical" (monozygotic) twins of both sexes, and that while in the case of females these are both normal, in the case of a dividing male zygote to form two individuals in one of them the sexual organs remain in the undifferentiated stage, so that the animal superficially resembles a female and is ordinarily recorded as such, although it is barren. The records for monozygotic twins accordingly go to increase the homosexual female and the heterosexual classes, while the homosexual male class, in which part of them really belong, does not receive any increment.

The theory of the free martin, F. R. LILLIE (*Science, n. ser., 43 (1916), No. 1113, pp. 611–613*).—A preliminary report of embryological investigations of the subject in which the author takes exception to the theory supported by Cole (see above) that the sterile free martin is really a male cozygotic with its mate.

An anatomical classification of 41 cases of bovine twins, all examined in utero, gave a ratio of 14 ♂ ♂ : 21 ♂ ♀ : 6 ♀ ♀. It is concluded from the examination of these 41 cases that about 97.5 per cent of bovine twins are monochorial, but in spite of this nearly all are dizygotic. In cattle a twin pregnancy is almost always a result of the fertilization of an ovum from each ovary. The rapid elongating ova meet and fuse and the blood vessels of the two circulations anastomose so that a constant interchange of blood takes place. "If both are males or both are females no harm results from this; but if one is

male and the other female, the reproductive system of the female is largely suppressed, and certain male organs even develop in the female. This is unquestionably to be interpreted as a case of hormone action." The author states that fertile free martins in cattle may be due to a monochorial condition in which the circulation of each fetus is closed.

Caracul sheep, F. R. Marshall, L. L. Heller, and V. O. McWhorter (*U. S. Dept. Agr. Yearbook 1915, pp. 249–262, pls. 12*).—This article treats of the breed characteristics of caracul sheep, their introduction into the United States and other countries, breeding methods, time and method of removing the skins, and classes of fur.

In experiments in crossing caracul rams and ewes of other breeds, conducted by this Department, poor results were obtained from the use of Cheviot and Merino ewes, thus indicating that none of the fine or medium wool breeds are likely to have much value in the production of fur-bearing lambs. Somewhat better results were obtained with Cotswold ewes. Crosses made with Barbados ewes gave skins of an inferior grade.

Fifteen half-bred caracul-Barbados yearling ewes were bred to an imported caracul ram, with considerable variation in the character of the offspring. Experiments were also conducted in crossing half-bred caracul rams and Barbados ewes. The results were not altogether satisfactory, and it is concluded that there is little prospect of securing marketable skins by breeding half-bred rams to ewes of any class. However, it is stated that a ram having one-half caracul blood will add to a flock an infusion of the body features which this breed shows and will in a small measure and at low cost improve a flock that is to be later bred up for fur production.

Observations show that the value of the skins may be often greatly lessened by allowing the lambs to reach too great an age. Occasionally a skin will improve in luster during the first few days after birth. It was found that in most cases the curl retained its original closeness until the third day, and that in about one-half the skins it had begun to open on the fifth day, while on the ninth day it had opened considerably. The luster improved in most cases up to the fifth day, the change being most marked in skins having a poor luster at birth.

Lamb-breeding tests, H. C. Wilson and A. J. Whelan (*Jour. Dept. Agr. Victoria, 14 (1916), No. 3, pp. 129–137, figs. 7*).—This reports a series of experiments conducted at the State Research Farm, Werribee, to determine the most profitable type of lamb to raise for export purposes and local trade.

First cross Lincoln Merino ewes of uniform quality were selected, and these were mated with representative rams of different breeds. The average lambing percentages for three years were Lincoln 92.3, Border Leicester 87.16, Dorset Horn 90.3, Shropshire 84, and Southdown 89.5, with English Leicester 91 as an average for two years.

At seventeen weeks the wether lambs of each of these crosses were weaned and sold in the market. The ewe lambs from each cross were retained for three weeks after the sale of the wethers and shorn, and the fleeces were classed and valued.

The data for the three years are given in detail.

A peculiar breed of goats, J. J. Hooper (*Science, n. ser., 43 (1916), No. 1112, p. 571*).—An account of a breed of goats raised in central and eastern Tennessee. It is stated that when suddenly frightened the hind legs become stiff and the animal jumps along until it recovers and trots off normally, or if greatly frightened the front legs become stiff also and the goat falls to the ground in a rigid condition. They have received the name of "stiff-legged" or "sensitive" goats.

[Pig-feeding experiments], M. J. CRONIN (*Dept. Agr. and Tech. Instr. Ireland, Dept. Com. Irish Pig-Breeding Indus., Minutes of Evidence, etc., 1915, p. 19*).—A comparison of cooked and uncooked meals for 42-lb. pigs favored the latter.

Further developments in ovariotomized fowl, H. D. GOODALE (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 30 (1916), No. 4, pp. 286–293*).—The development of several castrated Brown Leghorn females is described.

These individuals developed male plumage and other male characters. After a time, however, certain changes in the plumage of some individuals took place, best described as a change to or toward the female type, as the case might be. Still later the plumage changed again to or toward the male type. An examination showed that no regeneration of the ovary had occurred in these individuals, but that instead an organ sui generis had grown. A portion of the organ was removed from each bird and sectioned, and its structure found to be clearly neither that of the ovary nor that of the testes. The exact nature of these organs has not been determined, but their structure suggested that they have some relation to the epididymis.

The simultaneous administration of pituitary and thymus to growing chicks, S. S. MAXWELL (*Univ. Cal. Pubs., Physiol., 5 (1916), No. 2, pp. 5–8*).—The results of these experiments show that in the early stages of growth the pituitary feeding exerts a retarding influence which is more marked when a larger amount is administered, and that this retarding effect is not prevented by the simultaneous administration of thymus substance. When the birds were killed and weighings made of the ovary and testes, adrenals, thymus, thyroid, heart, and spleen, no constant difference was found between the pituitary-fed birds and the controls, except in the case of the thymus, which, despite the thymus administered, was much smaller in the pituitary-fed birds than in the controls. It is deemed probable that in these experiments the retardation of growth of the thymus and of increase in body weight are both due to the effect of the pituitary substance.

Experiments with laying hens, W. J. BUSS (*Ohio. Sta. Bul. 291 (1916), pp. 185–217*).—A series of experiments was conducted to compare the egg production of hens kept in close confinement with that of hens allowed practically free range. The following table summarizes the three experiments:

Range v. confinement for laying hens.

Experiments.	Condition.	Duration.	Average number in lot.	Mortality.	Gain or loss in weight per hen.	Cost of feed per hen.	Eggs per hen.	Cost of feed per dozen eggs.	Value of eggs per hen.
		Days.		*Per ct.*	*Pound.*			*Cents.*	
1	Confined	882	85	23.23	−0.16	$1.96	241	9.75	$4.22
1	On range	882	96	15.53	− .09	1.97	278	8.49	4.85
2	Confined	728	51	17.50	+ .02	1.69	244	8.31	4.57
2	On range	728	54	12.30	+ .04	1.74	316	6.59	6.01
3	Confined	364	91	20.00	+ .41	.74	90	9.95	1.69
3	On range	364	[illegible]	21.80	+ .47	.79	129	7.30	2.4[illegible]

Experiments were conducted to determine whether rations containing a large variety of feeds give an increase in returns sufficient to justify the extra trouble and expense involved in providing them. Lot 1 received shelled corn and a mash composed of ground corn and meat scrap about 8:5; lot 2, shelled corn and a mash composed of ground corn, bran, and meat scrap; and lot 3, shelled corn, wheat, and oats, and a mash composed in one test of

ground corn, bran, and meat scrap 10:10:7 and in the other of ground corn, bran, middlings, oil meat, and meat scrap 3:4:4:1:2. The results of the two experiments are summarized in the following table:

Variety and simple rations for laying hens.

Experiments.	Duration.	Lot.	Average number in lot.	Mortality.	Gain in weight per hen.	Cost of feed per hen.	Eggs per hen.	Cost of feed per dozen eggs.	Value of eggs per hen.
	Days.			*Per cent.*	*Pound.*			*Cents.*	
1	1,047	1	21	29.2	0.48	$2.27	351	7.74	$6.45
1	1,047	2	19	37.5	.53	2.19	293	8.99	5.28
1	1,047	3	22	33.3	.34	2.77	371	8.98	6.88
2	672	1	22	20.0	.36	1.35	186	8.73	3.44
2	672	2	21	32.0	.36	1.35	190	8.54	3.50
2	672	3	24	8.0	.11	1.84	202	10.96	3.82

In an experiment conducted for 364 days to study the effect of rations containing approximately 10, 15, and 20 per cent of protein upon the rate and economy of egg production by pullets, the grain mixture for all lots was made up of shelled corn and wheat 3:1. The mash mixtures for the different lots were composed of ground corn, bran, and meat scrap in the following proportions: Lot 1, 11:3:1; lot 2, 6:3:6; lot 3, 1:3:11.

The results are summarized in the following table:

Effect of varying the protein content of rations for pullets.

Lot.	Protein content of ration.	Breed.	Average number in lot.	Mortality	Gain or loss in weight per pullet.	Cost of feed per pullet.	Eggs per pullet.	Cost of feed per dozen eggs.	Value of eggs per pullet.
	Per cent.			*Per cent.*	*Pound.*			*Cents.*	
1	10	B. P. Rocks	52	28.8	+0.55	$0.90	105	10.26	$1.99
2	15	do	51	24.6	+ .60	1.17	158	8.88	2.98
3	20	do	51	33.9	+ .84	1.25	124	12.16	2.30
1	10	White Leghorns.	58	8.3	+ .17	.66	93	8.51	1.70
2	15	do	57	13.3	− .10	.85	142	7.17	2.63
3	20	do	58	6.7	+ .02	.97	133	8.79	2.44

Feeding acorns to fowls, A. HINK (*Deut. Tierärztl. Wchnschr., 23* (*1915*), *No. 22, p. 169; abs. in Deut. Landw. Tierzucht, 19* (*1915*), *No. 29, pp. 228, 229*).—Acorns were decorticated, pounded, and dried, mixed with bran and sugar, and 30 gm. daily per fowl added to the ordinary feed mixture.

The result was a decrease in egg laying, culminating in complete cessation. The yolk of the eggs was covered with a dirty colored brown membrane, the interior of the yolk also being affected. It is thought that these results are due to the tannin contained in the acorns. The albumin tannate formed in the digestive tract passes in the form of tannate of albumin and tannate of soda into the blood, where fresh tannin is liberated, and exercises its astringent action upon the capillaries of the ovary. The brownish color of the yolk of the egg is due to oxidation.

Poultry management; care of breeding stock and chicks, E. J. PETERSON (*North Dakota Sta. Circ. 11* (*1916*), *pp. 10, figs. 4*).—A general discussion of methods of poultry management.

A study of the preparation of frozen and dried eggs in the producing section, MARY E. PENNINGTON, M. K. JENKINS, W. A. STOCKING ET AL. (*U. S. Dept. Agr. Bul. 224 (1916), pp. 99, pls. 17, figs. 7*).—Descriptions and laboratory findings as to the various types of eggs occurring in the egg-breaking season have been previously noted (E. S. R., 31, p. 570). Details of the practical application of the principles of construction and equipment of egg-breaking establishments, observations in the packing house, the organization of candling room, breaking room, and wash room in accordance with suggestions made for improvement, and the laboratory findings in samples of the commercial product are correlated, discussed, and summarized in the present bulletin.

It was found in this study, carried on at a number of commercial egg-breaking houses in 1911 and 1912, that eggs commonly used for breaking stock by reputable firms are the small and oversized eggs, dirty and cracked eggs, and shrunken eggs. To check deterioration the eggs should be held in chilled surroundings before and during the process of candling, breaking, and mixing preparatory to freezing or drying.

All eggs, even during the spring months, should be candled previous to breaking. In order to insure well-candled eggs going to the breakage room the system of candling should be such that the work of the individual candlers is checked, and to prevent waste the eggs difficult to grade should be set aside by the regular candlers to be recandled by an expert. All eggs used in the preparation of frozen and dried eggs should be graded out of the shell as well as by the candle, because certain heavily infected eggs, such as sour eggs and eggs with green whites, can only be detected when broken.

In order to insure a good product, bacterial cleanliness and careful grading must be obtained during the process of preparation. The fingers of the breakers should be kept dry and clean. Not more than three eggs should be broken into a cup before emptying, and good eggs should not be saved when a bad egg has been broken into a cup with them. White and yolk are contaminated less by the mechanical than by the shell method of separation, and only clean eggs should be separated by the latter process.

The percentage of "rots" rejected on candling and the organisms in the liquid egg saved increases as the season advances.

Canned eggs with the majority of samples having counts of less than 5,000,000 bacteria per gram, and with 100,000 *Bacillus coli* or less can be prepared in the producing section from regular breaking stock, provided strict cleanliness and careful grading have been observed. The ammoniacal nitrogen will very seldom be over 0.0024 per cent on the wet basis or 0.0087 per cent on the dry basis. The amount of ammoniacal nitrogen in desiccated egg, however, is not deemed a reliable index to the quality of the raw material from which it is prepared, because this substance is volatilized unevenly during the process of desiccation.

A second-grade frozen product sometimes prepared from eggs showing incipient decomposition to the senses, such as "beginning sours" and eggs with green whites, was found not only heavily infected but chemically decomposed and unfit for food purposes. Only two grades of canned eggs should be prepared when grading eggs out of the shell, viz, food egg and tanners' egg. Leaking eggs handled on special trays between candling and breaking room and graded carefully are as fit for breaking as regular breaking stock. Tanners' egg contains markedly larger numbers of bacteria and larger amounts of ammoniacal nitrogen than does food egg.

The control of the supply of air to drying belts to prevent saturation from the liquid egg is an important factor in preventing multiplication of bacteria in the product during the process of desiccation.

The following eggs should be discarded during grading: Black, white, mixed, and sour rots, eggs with green whites, eggs with stuck yolks, musty eggs, moldy eggs, "blood rings," eggs containing diffuse blood, and eggs with abnormal odor. An appendix gives details of the conditions observed in the various establishments studied.

The bacterial infection of fresh eggs, P. B. Hadley and Dorothy W. Caldwell (*Rhode Island Sta. Bul. 164 (1916), pp. 3–70, figs. 3*).—After a historical résumé of investigations on the bacterial infection of eggs this bulletin takes up a report of experiments begun in 1911. The results of the study are summarized as follows:

Of 2,520 fresh eggs examined by the indirect method 8.7 per cent showed bacterial infection in the yolk. None of the 111 whites examined showed infection, while the yolks of the same eggs gave a percentage slightly less (4.5 per cent) than the average for the series (7.7). The percentage of infection obtained for individual hens per year varied between 2.8 and 15, the average being 9. No hen laid all sterile eggs during any full year. No correlation was observed between percentage of infection and hatchability, or between the percentage of infection and the fecundity, age of the hens, or season of the year. The percentage of infection for infertile and for fertilized eggs was essentially the same. The nature of the infecting organisms occurring in the eggs was briefly studied, and 40 bacterial types were obtained, including 11 cocci, 28 rods, and 1 spirillum.

It is concluded that the most probable source of primary egg infection is the ovaries of the fowl, which become infected by bacteria escaping through the intestinal wall into the portal circulation. The nature of the bacterial species occurring in the primary infection makes clear the fact that primary infection plays no rôle in bringing about the decomposition of eggs. For the factors determining this result we must look mainly to the secondary infections. The nature and extent of the normal primary infection stands in no causal relation to embryo mortality in incubating eggs, and losses in "dead-in-shell" eggs can not be explained on these grounds.

A bibliography of literature cited is given.

DAIRY FARMING—DAIRYING.

The value of raw, steamed, and ensiled raw and steamed potatoes for milk production, W. Völtz and W. Dietrich (*Landw. Jahrb., 48 (1915), No. 4, pp. 535–569*).—Potatoes prepared in various ways were tested as a supplement to a basal ration of meadow hay, oat straw, and brewers' grains.

Steamed potatoes and ensiled raw potatoes had little effect on the milk yield, but material gains were obtained from the feeding of ensiled steamed potatoes. The highest milk yield was obtained from raw potatoes and was 2.5 times the yield from steamed potatoes.

With all four preparations the fat and dry-matter contents of the milk were increased, the fat content being especially high with the raw ensiled and the steamed potatoes. The greater quantity of protein and fat-free dry matter were obtained from raw potatoes, followed by ensiled steamed and steamed potatoes.

Mangolds or swede turnips for dairy cows, J. J. Dunne (*Jour. Bd. Agr. [London], 23 (1916), No. 1, pp. 58–65*).—Comparisons were made at the Danish State Experimental Laboratory of the feeding value of swede turnips and mangolds for dairy cows. The average daily milk yield of the mangold-fed cows was 30.73 lbs. and for the turnip-fed cows, 31.46 lbs., while the fat percentages were 3.06 and 3.01, respectively. Little or no difference in the nutritive

value of roots of different percentages of solids was disclosed by the experiments, when these were used in conformity with their content of solids.

Nutritive value and digestibility of Juncus effusus and Scirpus lacustris used as litter, N. VON ERTZDORFF-KUPFFER (*Landw. Jahrb., 48 (1915), No. 3, pp. 429–487*).—In digestion experiments with rabbits it was found that *J. effusus* when freed from fat was readily eaten by the animals but was not well digested.

Feeding experiments with milch cows showed that a daily ration of 13 lbs. of *S. lacustris* hay had no bad effect upon their health but that the milk yield was decreased even if as low as 4.5 lbs. per head were fed. The percentages of the fat and total solids of the milk were not altered but the absolute quantity of these constituents was decreased. Feeding *S. lacustris* hay did not change the consistency, flavor, taste, or color of the butter but the Reichert-Meissl number was decreased and the iodin value increased.

The author considers these two plants to be of considerable value as litter.

Cooling milk, H. E. ROSS and T. J. MCINERNEY (*Cornell Reading Courses, 5 (1915), No. 102, pp. 55–71, figs. 6*).—This pamphlet treats of methods of cooling milk and types of coolers.

The results of experiments indicate that the bacteria content of milk held at a temperature of 50° F. increases slowly, while that of milk held at 90° increases rapidly whether the milk had either a small or a large number of bacteria in it originally.

Cooling milk by placing the cans in a tank of ice water is deemed a practical method for use on farm dairies. To cool the milk rapidly it must be stirred at frequent intervals, but stirring every 5 minutes caused a sufficiently rapid drop in temperature and the difference from stirring at intervals of 10 minutes was very slight. When sufficient quantities of ice were used stirring the water in the cooling tank had little effect on the rapidity of cooling.

In order to obtain the highest efficiency from the conical type of cooler it is absolutely necessary to stir the water inside the cooler. Lower temperatures can be obtained by using brine and ice than with ice water alone.

Artificial refrigeration (*Milk Dealer, 5 (1916), No. 8, pp. 26, 30*).—From milk plant surveys made by the Dairy Division of the U. S. Department of Agriculture, data were obtained on the cost of ice in plants where no refrigerating machines were used, and on the cost of operating the machines in plants where they were used. These figures were obtained from some of the smaller-sized plants in the east North Central States, and in all cases electric power was used for operating the compressor, so that very reliable costs could be obtained on this item. The power also included, in many cases, the amount used in operating the pasteurizer, bottle washer, etc. Some of the plants bought a small amount of ice for the delivery wagons. The overhead expense on the machine was figured at 16 per cent on the cost, 6 per cent interest on the money invested, and 10 per cent depreciation.

The average cost per year per gallon of daily capacity of plant in thirteen plants using artificial refrigeration was $1.44. The average cost in nine plants using ice was $2.25. It is pointed out, however, that these figures do not necessarily indicate that it is more economical for all plants to use artificial refrigeration, as the size of the plant and individual conditions must be determined by each dealer for himself.

A new method for the destruction of bacteria in large volumes of milk by means of electricity, F. C. LEWIS (*Jour. Bd. Agr. [London], 22 (1916), No. 12, pp. 1229–1238, pls. 2, fig. 1*).—A method of destroying bacteria in milk by means of electricity is described. The essential feature of the method consists in passing a suitable current of electricity through the milk during its passage

through a tube connecting a container with a receiving vessel. The electric current so acts that the major portion of all bacteria in the milk is killed, and no chemical alteration in the milk so treated has been observed.

Judged from the standpoint of the percentage reduction, the electrical method gave highly satisfactory results (over 99.9 per cent) as well as from the standpoint of the presence of *Bacillus coli* (or manurial contamination).

The results of feeding tubercle-bacilli-containing milk, treated and untreated, to guinea pigs also indicated that the electrical treatment is an effective destroyer of the tubercle bacilli.

It is stated that even in the hottest weather the milk is perfectly fresh for three or four days after treatment. The change which ultimately takes place is a characteristic one, viz, a mild, pleasant, acid reaction and flavor. The putrefaction which is noticeable so often in stale steam "sterilized" milk has never been observed. Milk treated by this electrical process is deemed perfectly suitable as a medium for the action of culture ferments.

The electrical treatment of milk for infant feeding, J. M. Beattie (*Jour. State Med., 24 (1916), No. 4, pp. 97–113, figs. 4*).—Experimental data are given which indicate that a rapidly alternating current of electricity is efficient in reducing the bacterial content of milk to a minimum without impairing the chemical constitution of the milk. Bacteriological tests of treated and untreated milk, supplemented by animal inoculation experiments, showed that disease-producing bacteria, including *Bacillus tuberculosis*, were destroyed by the method. "The milk is not sterilized in the strictest sense of the word, but there is a reduction in the total number of bacteria by 99.93 per cent, and . . . the milk will keep perfectly sweet for at least three or four days after treatment. . . . The taste is not in any way altered." In the author's opinion, this milk is perfectly satisfactory as a food for infants.

Scoring of milk and cream, W. M. Esten and Christie J. Mason (*Connecticut Storrs Sta. Bul. 83 (1915), p. 135*).—Standards used in the scoring of milk and cream for acidity and bacterial count in a dairyman's contest are given, and the results briefly reported.

The production of first-grade cream in Oklahoma, R. C. Potts (*Oklahoma Sta. Bul. 108 (1916), pp. 3–11, figs. 5*).—The topics discussed in this bulletin are the requirements for producing first-grade cream, the necessity of low temperature, acidity of mixed cream, agencies for keeping cream cold, cooling cream with well water, and insulated refrigerator cream tanks. Charts and a table show the relation of temperature and age of cream to the development of acidity in each separate skimming.

Tests and comparisons of commercial lactic starters, Christie J. Mason (*Connecticut Storrs Sta. Bul. 83 (1915), pp. 112–125*).—This reports tests and comparisons made of six commercial starters, the strongest and most uniform of which is reported as Ericsson's milk culture.

It is stated that transferring milk cultures of *B. lactis acidi* daily will in most cases increase the activity of the bacteria. Those not sufficiently active after the fourth or fifth transfer are of doubtful value. Cultures intended for use as starters should be propagated at as low a temperature as is used for ripening the milk or cream. Results of the experiments made indicate that the kinds of media best adapted for the long keeping of this class of lactic organisms are milk with calcium carbonate added and standard bouillon containing 1 per cent of saccharose. Sealing tubes with paraffin assists in maintaining the activity of cultures kept for long periods of time.

Ice cream. Evaporated milk (*Maine Sta. Off. Insp. 76 (1916), pp. 9–20*).—Analyses are given of various brands of evaporated and condensed milk and notes on the examination of ice cream.

Bacterial studies of Camembert cheese, W. M. Esten and Christie J. Mason (*Connecticut Storrs Sta. Bul. 83 (1915), pp. 103–111*).—In bacterial examinations of Camembert cheese from many different sources it was found that the highest numbers of bacteria were usually found about the third day, after which the numbers decreased, and most rapidly between the seventh and eleventh days. With fluctuations the numbers decreased gradually until the cheeses were ripe. In the majority of cases 99 per cent or more of the bacteria in the interior of the cheese were of the lactic acid type. The proportion of liquefying types was small, especially where a starter was used, as was generally done.

In a comparison of the types of *Bacterium lactis acidi* found in European and American cheeses, the European form made somewhat larger colonies in litmus lactose gelatin plates and grew on the surface, while the American form was always found below the surface. The European form grew more abundantly on agar slants and in bouillon. Milk soured with cultures of the two forms developed no noticeable difference in flavor or odor either when first curdled or when kept for four weeks at the temperature used for ripening cheese. Cheeses made with starters of these two types showed no real difference in flavor.

Practically every cheese tested showed the presence of yeasts. They were most abundant on the surface, but were uniformly found in the curd. Rarely the numbers reached several millions per gram, but in most cases there were only a few thousands per gram, the highest numbers being usually found between the fourteenth and twenty-first days. Several different species were found, the most common being an acid producer which in litmus lactose gelatin resembled *B. lactis ærogenes.* Several cases of gassy cheese were apparently due to yeasts. Some of the yeasts from cheese produced in milk an acid, others an alkaline reaction; some peptonized milk. Those tested were able to develop in the absence of air, but not so rapidly as in aerobic conditions. They were not greatly restrained by amounts of salt as large as are present in cheese.

The acidity of 10 samples ranged from 1.67 to 3.2 per cent. The presence of *Bacillus bulgaricus* was ascertained, but it is stated that it is doubtful if this organism has any decided influence on the ripening of Camembert, since it grows best at from 44 to 45° C. and only very slowly at the lower temperatures, from 10 to 15°, at which Camembert ripens. As Camembert ripens within five weeks it is also very doubtful if *B. bulgaricus* could develop sufficiently in that time to affect the flavor.

Tests showed only one-ninth as many bacteria under anaerobic as under aerobic conditions, and in tests of the slime only one-fortieth as many. No species were found in anaerobic cultures which were not present in the aerobic.

Bacterial counts were made from the slime of cheeses of different origin. The surface slime contained a great number of different types of organisms. However, it is thought that they contribute but little to the production of flavor.

Tests conducted with Roquefort cheese gave results very similar to those given for Camembert. The lactic acid bacillus, *B. lactis acidi,* was always found in nearly pure cultures and other species did not appear uniformly enough to suggest any special importance in ripening the cheese. Yeasts were present in four out of the five important brands examined. *B. bulgaricus* is probably almost always present in Roquefort cheese. Tests of acidity showed a range of from 1.64 to 4.95 per cent. *B. bulgaricus* was also found in other

soft cheeses, as Neufchatel and Gorgonzola. Anaerobic cultures developed no species not found in the aerobic cultures.

Classification and nomenclature of lactic-acid organisms, F. Löhnis (*Milchw. Zentbl., 45 (1916), No. 4, pp. 49–51; abs. in Cream. and Milk Plant Mo., 4 (1916), No. 8, pp. 18, 19*).—This is a paper presented by F. Löhnis at the sixth International Dairy Congress, in which he defends his classification of lactic-acid organisms, as published in his Handbook of Agricultural Bacteriology in 1910 (E. S. R., 23, p. 720).

It is stated that "the establishment of these groups has been criticized adversely. Although it was recognized that the organisms of group 2 were closely related to the typical streptococci it was insisted that they be placed among the bacteria, owing to their generally elongated form. In that case it would have been necessary to place the related streptococci also among the bacteria. Aside from the uniform character of the streptococci from a physiological viewpoint there would be grave practical objections to further enlarging a genus that already embraces many organisms of widely different natures.

"It was proposed to separate the micrococci from the lactic-acid bacteria on account of their ability to dissolve casein. This would leave in group 4 only such micrococci as possessed no proteolytic properties. But this property is known to be highly inconsistent, and its adoption as a criterion of classification would greatly impair the natural grouping.

"These criticisms and others, including those of Rogers and Gorini, are attributed by the author to failure to distinguish accurately at all times whether the classification is intended for practical or for scientific purposes, which may agree but may also diverge. From a practical viewpoint it is quite justified to comprehend liquefying micrococci and other casein-dissolving bacteria under such a name as casease bacteria. Likewise the nature and intensity of lactic-acid production may be of practical importance, leading to a distinction between true and false lactic-acid bacteria. But, for scientific classification, the international rules of botanical momenclature must be accepted. In the establishment of groups it is necessary to include related forms although they may not generate acid. It is no more possible to find a system based on scientific grounds for the lactic-acid bacteria alone, to say nothing of the so-called true lactic-acid bacteria, than it would be to find one for flowering plants that produce fragrance. Practical purposes can be fully met by making suitable subdivisions of types within the groups, as between acid-forming, casein-dissolving, and slime-producing varieties."

VETERINARY MEDICINE.

Animal disease and our food supply, E. B. Mitchell (*U. S. Dept. Agr. Yearbook 1915, pp. 159–172, pls. 2*).—This article, prepared under the direction of the chief of the Bureau of Animal Industry, is a popular discussion of the relation of animal disease to food supply. Attention is called to the fact that while during the recent outbreak of foot-and-mouth disease 168,158 animals valued at approximately $5,676,000 were destroyed this represented less than 0.1 per cent of the total number of cattle, sheep, and swine on the farms of the country. The money that the country paid to rid itself of an exceptionally costly outbreak was less than 3 per cent of the annual tax that other animal diseases levy upon it.

Economic importance of the Federal inspection of meats, G. Ditewig (*U. S. Dept. Agr. Yearbook 1915, pp. 273–280*).—A popular discussion.

Investigations on the disinfectant strength of disinfectants in relation to their concentration, J. P. GREGERSEN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig.*, *77* (*1915*), *No. 2*, *pp. 168–185*).—Experimental data submitted indicate that the reciprocal of the time in which an antiseptic kills a given micro-organism may serve as a measure of the disinfectant strength of the material under given conditions of concentration and temperature. The disinfectant strength of aqueous solutions of hydrochloric acid, mercuric chlorid, iodin-potassium iodid, and formaldehyde is proportional to the concentration. For aqueous solutions of phenol, thymol, and chloral hydrate the disinfectant strength is proportional to the fourth power of the concentration of the material.

The product of the concentration and the time is designated as the "disinfectant constant." To compare the disinfectant strengths of various materials the relation between the reciprocal values of their disinfectant constants can be used.

The formation of specific proteoclastic ferments in response to the parenteral injection of foreign proteins, FLORENCE HULTON (*Jour. Biol. Chem.*, *25* (*1916*), *No. 1*, *pp. 163–171*).—"Protamin, phaseolin, and gliadin are not digested to any degree by either normal serum or that of an animal injected with these substances. Casein and soy-bean globulin are digested to a greater extent by the normal serum than by that of the injected animal. Edestin and milk albumin are digested to the same degree by the normal and experimental serum. Bence-Jones protein is digested to a marked degree by both sera and equally well in each case."

Earlier work on the subject is briefly reviewed and a bibliography of the important contributions included. See also a previous note by Taylor and Hulton (E. S. R., 34, p. 578).

Cachexia following the parenteral injection of homogenous organ proteins, H. DOLD (*Ztschr. Immunitätsf. u. Expt. Ther.*, *I, Orig.*, *24* (*1916*), *No. 4*, *pp. 355–360*).—Confirming the findings of earlier investigators it is shown that the repeated parenteral injection of sterile aqueous organ extracts into rabbits and guinea pigs causes a decided emaciation. In rabbits the loss varied from 12 to 18 per cent in from 11 to 14 days. In guinea pigs the loss varied from 18 to 24 per cent in 31 days.

Histologically the organs of the animals indicated a general atrophy. An acute inflammation was manifest at the site of injection.

On the mechanism of the cleavage process in Abderhalden's dialysis procedure, F. PLAUT (*Ztschr. Immunitätsf. u. Expt. Ther.*, *I, Orig.*, *24* (*1916*), *No. 4*, *pp. 361–379*).—It is indicated that in the dialysis procedure the organ substrate has a nonspecific hemolytic action. By digesting the substrate with serum this action can be preserved. By the repeated digestion with blood these organ preparations become antihemolytic. These phenomena are attributable to the adsorption of protein and are similar to the behavior of inorganic suspension colloids.

The significance of these phenomena in connection with the dialysis procedure is indicated. The adsorption capacity can be greatly reduced and the disturbing side reactions weakened by thoroughly boiling the organ substrate shortly before using, as well as by the complete removal of blood.

The Abderhalden dialysis procedure used in testing the serum of horses, BERNHARDT and HOFHERR (*Berlin. Tierärztl. Wchnschr.*, *31* (*1915*), *No. 33*, *pp. 385–389*).—The investigation has demonstrated that the serum of horses contains protein-cleaving enzyms, and that these enzyms can be detected in the serum even after a fasting period of 26 hours. They are easily inactivated by heating at from 56 to 60° C. The age and hemolytic properties of the serum have a marked influence on the intensity of the ninhydrin reaction, so that

hemolytic serum and that which is more than 24 hours old should not be used in the dialysis procedure. From the experimental results, it is concluded that on account of the presence of the digestive ferments in the serum of the horse the dialysis procedure for the detection of pregnancy is only of value when it can be definitely established that the serum is nearly free from these ferments.

Investigations on the control of foot-and-mouth disease with "rindol," MATTHIESEN and GLÄSSER (*Berlin. Tierärztl. Wchnschr., 32 (1916), No. 10, pp. 109–114*).—The authors have demonstrated that the preparation "rindol," administered as directed by the producer, has no curative effect on diseased animals, nor does it confer any immunity on healthy animals which may subsequently be exposed to infection. The experimental data, together with the clinical findings, are reported in detail.

Contributions to the serodiagnosis of glanders; the use of polyvalent extracts in the examination of the serum for complement deviation, W. PFEILER (*Berlin. Tierärztl. Wchnschr., 31 (1915), Nos. 34, pp. 397–403; 35, pp. 411–413*).—Experimental data obtained in the course of an investigation on the improvement of the serodiagnostic methods for the detection of glanders are submitted. It was found that the use of polyvalent extracts in the complement-deviation procedure increased the sensitiveness of the reaction considerably. The experimental results are discussed in detail.

The agglutinin, precipitin, and complement-deviating substance content of the aqueous and vitreous humor and other body fluids of glanderous horses, BORCHARDT (*Arch. Wiss. u. Prakt. Tierheilk., 41 (1915), No. 6, pp. 373–425*).—It has been observed that the synovial fluid and the serous fluids of the pericardial, peritoneal, and pleural cavities contain appreciable amounts of agglutinin, precipitin, and complement-deviating substances. The aqueous and vitreous humor, however, contains none, or only extremely small amounts, of these antibodies.

A bibliography of 63 references cited is appended.

The toxicity of the blood serum of luetics for anaphylactic (sensitized) guinea pigs, W. MISCH (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1916), No. 4, pp. 380–386*).—Human syphilitic serum is found to be more toxic for sensitized guinea pigs than the serum of nonsyphilitics. This phenomenon is not manifested when normal untreated guinea pigs are injected with the respective sera. It is indicated that this increased toxicity of luetic serum is caused by an increase of proteins in the serum, especially globulins.

Observations upon complement fixation in the diagnosis of pulmonary tuberculosis, C. F. CRAIG (*Amer. Jour. Med. Sci., 150 (1915), No. 6, pp. 781–791; abs. in Internat. Centbl. Gesam. Tuberkulose Forsch., 10 (1916), No. 2, p. 46*).—Experimental data presented demonstrate that "complement-binding antibodies are present in the blood serum of both active and clinically inactive tuberculous infections. A polyvalent antigen prepared from several strains of the human tubercle bacillus has been found to give excellent results in complement fixation for tuberculosis. With the test described complement fixation gave a positive reaction in 96.2 per cent of cases of active tuberculosis and in 66.1 per cent of the cases of clinically inactive tuberculosis. The test was negative in normal individuals and in patients suffering from other diseases with the exception of two patients infected with syphilis in whom symptoms of a coincident tuberculous infection was also present. The test does not give positive results with the blood serum of syphilitics in whom there is no coincident tuberculous infection. The reaction, when positive, is specific and apparently indicates the presence of an active tuberculous focus, although there may be no symptoms of the disease present. Positive results are obtained in a large

percentage (66 per cent) of clinically inactive cases of pulmonary tuberculosis, and such a result indicates that though it may be quiescent the infection has not disappeared. The results obtained with the test described are practically as good as those obtained with the Wassermann test for syphilis."

The significance of bovine tuberculosis to human tuberculosis, J. Orth (*Naturwissenschaften, 4 (1916), No. 10, pp. 121–124*).—This article discusses the relation of two forms of the disease and indicates the necessity of controlling, and exterminating if possible, the bovine form. Some statistical data on the progress of the disease in Germany in children under 15 years of age are included.

Tuberculosis in the dog and its relation to human tuberculosis, H. Markus and H. Schornagel (*Folia Microbiol. [Delft], 4 (1916), No. 2, pp. 189–205, pls. 4*).—From their observation and experience the authors conclude that the occurrence of canine tuberculosis is more frequent than is ordinarily suspected. The dog is undoubtedly infected in the greatest number of cases by the human organism. Healthy dogs may also become a source of infection for man by carrying the virulent virus from the street (dried sputum, etc.) and thus spreading it in the house. A rational prophylactic measure against the disease in such form is to keep the dog in a sanitary condition.

Tuberculosis in Finmarken (the most northerly part of Norway) with special reference to the living conditions, A. B. Wessel (*Tidsskr. Norske Lægefor., 34 (1914), Nos. 5, pp. 222–230, figs. 2; 6, pp. 273–281; 7, pp. 310–326, figs. 14; abs. in Internat. Centbl. Gesam. Tuberkulose Forsch., 10 (1916), No. 1, p. 14*).—The mortality from tuberculosis in this Arctic region is 4.5 per 1,000 and has increased steadily since 1860. The cause of such increase is attributed to a deep-seated house infection. The author gives an interesting detailed description of the living conditions of the various inhabitants of this region, viz, Norwegians, Laps, and Finns.

Studies on the biochemistry and chemotherapy of tuberculosis.—XIV, The tuberculocidal action of arsenic compounds and their distribution in the tuberculous organism, A. Arkin and H. J. Corper (*Jour. Infect. Diseases, 18 (1916), No. 4, pp. 335–348, fig. 1*).—Continuing previous work (E. S. R., 33, p. 877), experimental data have demonstrated that "sodium arsenite in dilution of from 0.1 to 0.0001 per cent and sodium cacodylate in dilution of from 2 to 0.002 per cent have no germicidal action on human tubercle bacilli in 24 hours at 37° C. Mercury cacodylate in dilutions of from 1 to 0.001 per cent has a germicidal action on human tubercle bacilli in 24 hours at 37°. This action is in all probability due to the mercury and not to the cacodylate radical. Atoxyl, arsacetin, and neosalvarsan in dilutions of from 1 to 0.001 per cent have no germicidal action on human tubercle bacilli in 24 hours at 37°."

It is evident that these inorganic and organic preparations of arsenic have no specific action on human tubercle bacilli, and if of any therapeutic value at all it is because of their favorable influence on metabolism in general. The arsenic was found in the liver, lungs, kidneys, blood, spleen, and tubercular tissues (lymph glands of the guinea pig and eye of the rabbit), the concentrations in these different tissues not varying to a great extent. There was no evidence of accumulation in the tuberculous tissues.

Sodium stannate in a concentration of 1 per cent was not germicidal toward tubercle bacilli in 48 hours at 37°.

Studies on the biochemistry and chemotherapy of tuberculosis.—XV, The bactericidal and fungicidal action of copper salts, Lydia M. DeWitt and Hope Sherman (*Jour. Infect. Diseases, 18 (1916), No. 4, pp. 368–382*).—It is concluded that copper, either as a bactericide or as a fungicide, is unsatisfactory and unreliable, especially when used for only short periods of time.

A certain selective specificity was apparent, in that some organisms were markedly susceptible, while others were very resistant to the action of copper.

Copper is but slightly bactericidal for the tubercle bacillus, although dilutions of 1 : 100,000 prevent its growth in the test tube. In general, however, it was not possible to show any specific affinity of copper for tuberculous tissues.

Contributions to the serodiagnosis of typhus, PAPAMARKU (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 77 (1915), No. 2, pp. 186–197, figs. 2*).—The complement-fixation reaction in typhus, using alcoholic organ extracts as antigen, yields a high percentage of positive results when fresh serum from sick and convalescent patients is used. The percentage of positive results is greatly reduced by using inactive sera. The reaction can be obtained in the third day of the disease, and continuing for a period of two weeks. It is probably specific, although positive reactions have been obtained by the use of syphilitic as well as typhus-fever organ extracts as antigen.

"Lungworms," a preliminary report on treatment, with some observations regarding the epidemiology and life history of the parasite, W. B. HERMS and S. B. FREEBORN (*California Sta. Circ. 148 (1916), pp. 8, figs. 2*).—The data here presented relate to three species of lungworms of economic importance in California, namely, *Dictyocaulus viviparous* affecting calves, deer, and rarely sheep; *D. filaria* affecting sheep, goats, camels, deer, and sometimes calves; and *Metastrongylus apri* affecting swine.

In experimental work carried on by E. M. Ledyard with various chemicals, including turpentine, benzin, chloroform, and other substances, used separately and in various combinations, chloroform administered in both nostrils proved to be most effective. A herd of 150 Angora goats was successfully treated with 1.5 cc. of chloroform in each nostril during the fall of 1914. In every instance the animal became slightly anesthetized for a period varying from 2 to 20 minutes, but no bad results developed in the herd, which after two more treatments became apparently free from lungworms. It was supposed at first that chloroform actually killed the lungworms in situ and that they were eliminated by coughing, but it was later found that the chloroform merely stupefied the worms and at the same time irritated the throat and windpipe, thus causing a prolonged paroxysm of coughing during which the worms are coughed up and swallowed.

In searching for a standard safe and effective dose of chloroform, it was found that one animal may require five times the amount needed to produce the same effect in another. This variability has led to the practice of administering enough chloroform to make the treated animal slightly groggy, the maximum dosage having been 11 cc. for calves and 3 cc. for goats. Animals to be treated should be confined in a corral which is free from grass and other vegetation. Half the dose is administered in each nostril, and the action of the chloroform is enhanced by stopping the nostrils with the hand or cotton plugs for a few moments after injection. Two hours after treatment a saline purge of Epsom or Glauber's salts should be given the animals.

Brief reference is made to the life history of these lung parasites. Attention is called to the fact that von Linden and Zenneck report, in an article previously noted (E. S. R., 34, p. 879), observations on two types of embryos, one occurring in the mucus of the trachea and of the space behind the nose, and consisting of slim, strong moving embryos, capable of living outside the body, the other occurring in the lungs and consisting of short, thick, slow moving embryos which are unable to live outside the body. It is pointed out that deer and possibly cows may act as carriers and should be excluded from the pasture land of susceptible stock.

Some lice and mites of the hen, G. H. Lamson, Jr., and J. A. Manter (*Connecticut Storrs Sta. Bul. 86 (1916), pp. 169–196, figs. 15*).—A general account is given of the more important lice and mites which commonly attack the domestic fowl, their life history, and remedial measures, together with brief reference to some experimental work with remedies.

The pests thus considered are the large body louse (*Menopon biscriatum*), the small body louse (*M. pallidum*), the head louse (*Lipeurus heterographus*), poultry mite or roost mite (*Dermanyssus gallinæ*), and scabies or scaly leg mite (*Cnemidocoptes mutans*).

The large body louse is one of the species most commonly found upon poultry. Its eggs, which are attached securely to the feathers near the body of the host, were found on chickens to hatch in from five to seven days, the young reaching maturity and laying eggs in somewhat less than 17 days, which would indicate a life cycle of about three weeks. On infested chickens it is more abundant under the wings, but the area most commonly infested on older birds is around the vent, although specimens will be found on the head and scattered about the body. As many as 3,600 individuals were counted from one chicken, and this is thought to have included not more than one-half of those present. The species readily travels from one bird to another and often to other barnyard fowls, having been found by the authors upon turkeys.

The small body louse is reported by most authors to be the commonest louse infesting the hen in the United States. Its general habits and life history are similar to those of the large body louse, but it is usually more abundant around the vent. It has been reported to infest horses which have been stabled near poultry.

The head louse is most prominent on the feathers of the head but is often found on the neck and occasionally on the feathers of the wings. It is much less active than the body lice above mentioned. Its eggs, which are glued to the feathers of the head and neck, hatch on chickens in from four to five days and reach maturity and oviposit in 10 days, the life cycle thus occupying a period of about 15 days. Several less important lice mentioned are *L. variabilis*, usually found upon the feathers of the wing, *Goniocotes abdominalis*, and *G. hologaster* upon the feathers on the underside of the hen.

The most effective control measure tested by the authors for body lice consists in the application of a dilution of mercurial ointment or blue ointment. One hundred and four chickens were treated in a laboratory with this ointment at various strengths, the applications being made to different regions of the body. The normal strength of blue ointment was found to be very effective and even a dilution of this proved satisfactory, but the effectiveness decreased with a decrease in the amount of mercury present. On chickens the most vulnerable point of attack proved to be on the body under the wings, while an application around the vent was also effective. The method recommended consists in parting the feathers and applying an amount of ointment about the size of a pea to the flesh just below the vent. It is pointed out that the use of sulphur and lard, one of the commonest mixtures prescribed for lice on the heads of chickens, is dangerous.

The poultry mite attacks the fowl only at night, when it crawls upon the roost from its hiding place between the boards supporting the roosts and sides of the poultry house. The eggs are laid from early spring until late fall, usually about four eggs being laid in a period of two or three days and repeated at intervals, and hatch in from two to six days. The period required for completing their life cycle depends upon the time required in gaining access to the fowl.

The authors have found carbolineum far more effective than kerosene oil, zenoleum, or carbolic acid in ridding the hen house of these mites, and it is recommended for use where a comparatively small quantity is required, but where large quantities are needed one of the coal-tar mixtures bought by the barrel at a lower rate is preferable. A diagram is given of a roost constructed in a manner to reduce the breeding places of the mites.

The scaly leg mite burrows under the skin and causes large irregular scales and gray masses on the feet of hens. This mite may be killed by any oil preparation which has a penetrating power when applied after the scales have been loosened by soaking and scrubbing the legs with a brush in warm soapy water. The authors have found nothing better than caraway oil mixed with lard 1:4.

The importance of sanitation in the poultry house and on the range is emphasized, and the care of sitting hens, dusting and the use of dust baths, and the use of sulphur on chickens are briefly discussed.

Bacillary white diarrhea of young chicks: Its eradication by the elimination of infected breeding stock, L. F. Rettger, W. F. Kirkpatrick, and R. E. Jones (*Connecticut Storrs Sta. Bul. 85 (1915), pp. 151–167, figs. 2*).—In this fifth report on studies of white diarrhea of young chicks (E. S. R., 31, p. 484) the authors report upon the eradication of the disease through eliminating the reacting fowls from the breeding stock by means of the agglutination test.

A summary of the work and the conclusions drawn therefrom are as follows: "During the first year of the present campaign against bacillary white diarrhea in this State 14,617 individual fowls and 107 flocks were tested by the macroscopic agglutination test. The number of reacting (infected) fowls was 1,440, or 9.85 per cent of the total number. Of 13,831 hens 1,417, or 10.24 per cent, were positive, and of the 786 males tested 23, or 2.9 per cent, reacted. The testes of two of the males harbored *Bacterium pullorum* in large numbers. In four of the reacting males pericarditis and infection of the heart sac with the same organism was observed.

"The retesting of flocks which on the first examination by this method contained bacillus carriers, and from which the reactors had been removed, gave widely different results. In four flocks out of a total of 13 no reactors were found at the time of the second test. In the other nine the percentage of infection varied from 0.6 to 25.7 per cent, the number in each instance being decidedly less than in the first test. The breeding records obtained from the owners were most encouraging, and with a few exceptions showed a high degree of success as compared with previous years.

"The greatest value of the agglutination test is in its determination of infected and uninfected flocks. On the basis of 100 per cent of negative tests in a flock the most successful campaign may be waged against bacillary white diarrhea. Only such flocks should be employed as future breeders, and all encouragement should be given to the owners to find a ready market for eggs for hatching and for day-old chicks. On the other hand, where there is no certainty that ovarian infection does not exist the fowls should not be used as breeders until they are known to be free from all taint of the disease."

RURAL ENGINEERING.

How engineering may help farm life, E. B. McCormick (*U. S. Dept. Agr. Yearbook 1915, pp. 101–112, fig. 1*).—In a brief discussion of the application of engineering efficiency to farm life and operations, it is pointed out that the engineer can be of special assistance to the farmer in the "economical and

comprehensive use of machinery of various types; the arrangement and grouping of farm buildings and structures, as well as the construction of individual buildings; and the development of natural resources for furnishing power, as a substitute for manual and animal labor now employed at considerable inconvenience and excessive overhead cost."

The law of irrigation, compiled by C. F. Davis (*Fort Collins, Colo.: [Compiler], 1915, pp. 346*).—This text, comprising 26 lectures, is intended for the secondary schools in the West in which a course in the law of irrigation is given. The lectures aim to give a working knowledge of the law which controls the large number of questions that have arisen from the appropriation and use of water in the western United States and also deal with the history of irrigation and irrigation enterprises in other lands. While the lectures are based primarily upon the law in Colorado, they also point out wherein this law differs from the laws in other States.

Irrigation practice and engineering.—III, Irrigation structures and distribution system, B. A. Etcheverry (*New York and London: McGraw-Hill Book Co., 1916, vol. 3, pp. XV+438, pls. 35, figs. 186*).—This, the third volume of this work (E. S. R., 34, p. 482), is devoted to that part of irrigation engineering related to irrigation structures and distribution systems. It deals with the following subjects:

Diversion works; diversion weirs; design of diversion weirs; design of diversion weirs of the loose rock-fill Indian type; dynamic forces produced by flow of water over weirs and their effect on the design of weirs; description of diversion weirs; scouring sluices, fish ladders, logways; main head gates or regulator for canal system; gate-lifting devices; canal spillways, escapes, and wasteways; sand gates—sand boxes; crossings with drainage channels; drops and chutes in canals; distribution system; check gates; lateral head gates and delivery gates; road and railroad crossings with canals, culverts, inverted siphons, and bridges; special types of distribution systems—wooden flume, wooden pipe, and cement pipe distribution systems; and measuring devices.

The flow of water in irrigation channels, G. H. Ellis (*Proc. Amer. Soc. Civ. Engin., 42 (1916), No. 2, pp. 187–204, pls. 2, figs. 4*).—This paper presents a study of experimental data previously reported by Scobey (E. S. R., 33, p. 183), the result of which was to deduce an experimental formula $V=C\ R^{0.69}\ S^{0.5}$ for the flow of water in channels in which the coefficient C varies from about 40 to 140, depending on the roughness of the channel. "For general conditions the following formulas are submitted: For concrete channels, $V=105\ R^{0.69}\ S^{0.5}$; for wooden channels, $V=100\ R^{0.69}\ S^{0.5}$; for earth canals, $V=60\ R^{0.69}\ S^{0.5}$." Incidentally the need of care in the selection of a value for the coefficient of roughness is brought out.

The automatic volumeter, E. G. Hopson (*Proc. Amer. Soc. Civ. Engin., 41 (1915), No. 8, pp. 1891–1908, figs. 9*).—"This paper describes an apparatus intended to gage the flow of fluids by the collection of a proportionate part of the flow, or its equivalent, in a small vessel where it can be readily measured at any time. This result is accomplished by the use of very small orifices for the purpose of regulating the discharge into or out of the collecting vessel, and other special arrangements whereby the pressure head under which the discharge into the collecting vessel takes place is at all times the equivalent, or a constant ratio, of the velocity head of the liquid or gas being measured. . . .

"The practical operation of the device should probably be first for irrigation uses, and particularly for measurements of individual service flows or flows in small laterals. . . .

"The device, as applied to irrigation use, has the advantage that it is independent of such matters as drifting sand, weeds, or any floating or suspended

trash. Nothing in suspension will pass into the influent pipe, which has practically no velocity of flow and has, moreover, an upward course. Solid matter, if placed in the influent pipe, would, in fact, settle back into the stream. Even if suspended or floating material should get into the measuring vessels, it would not pass through the controlling orifice on account of the internal arrangements."

Diagram giving excess loss of head in 90° bends, F. S. BAILEY (*Engin. News, 75 (1916), No. 9, pp. 412, 413, fig. 1*).—This diagram gives the excess loss of head in 90° bends in cast-iron water pipe and is based on a formula proposed by Fuller (E. S. R., 31, p. 384).

Machine for placing concrete lining in canals, E. I. DAVIS (*Engin. News, 75 (1916), No. 6, pp. 264–267, figs. 4*).—This is a description of the construction and operation of a machine developed on the U. S. Reclamation Service canal at Hermiston, Oreg. This consists essentially of a traveling form into which concrete, mixed immediately alongside, is dumped and forced out at the bottom to form the lining of the irrigation canal.

Experiments on the economical use of irrigation water in Idaho, D. H. BARK (*U. S. Dept. Agr. Bul. 339 (1916), pp. 57, pls. 3, figs. 13*).—This report covers the same ground as two previous reports (E. S. R., 29, p. 180; 33, p. 583).

Ground water in San Joaquin Valley, California, W. C. MENDENHALL, R. B. DOLE, and H. STABLER (*U. S. Geol. Survey, Water-Supply Paper 398 (1916), pp. 310, pls. 5, figs. 4*).—This report deals with the occurrence, quality, and utilization of the ground water of an area of about 7,500,000 acres in the Great Central Valley of California, with particular reference to its use for irrigation and domestic purposes. The results of pumping tests on about 50 irrigation plants in the valley are also reported, together with a summary of points to be observed in order to obtain good service from a pumping plant.

With reference to the quality of the waters of the valley, it is concluded that "the waters of the perennial streams are entirely suitable for irrigation. Storage to remove suspended matter renders them acceptable for boiler use, and filtration would purify them for domestic supply. On the east side between the Sierra and the trough of the valley, wells from 20 to 1,000 ft. deep generally yield calcium carbonate waters, moderate in total solids and in total hardness and distinguishable by their low sulphate content. These waters are suitable for domestic use, good or fair for irrigation, and fair or poor for boiler use. Many of them have been successfully applied to diversified crops for several years. Water from wells less than 50 ft. deep is generally poorer than that from slightly deeper wells. On the west side wells between the coast range and the trough of the valley yield hard, gypseous waters high in mineral content and especially in sulphate. Nearly all the waters taste of alkali, but they are potable except the most highly concentrated ones close to the foothills. The west-side waters are poorer for irrigation than those of the east side, but few of them are unfit for use if proper care is taken to prevent accumulation of alkali. . . .

"In the axis or trough of the valley wells yield waters distinguishable by the predominance of sodium and potassium among the basic radicles. . . . Nearly all except the salt waters and those from wells less than 300 ft. deep in or near the bed of Tulare Lake are potable. Many of those north of Kings River are poor for irrigation. . . . The deep artesian waters south of Kings River are good or fair for irrigation and for boiler use. Borings more than 1,200 ft. deep as far south as Fresno County yield strong salt waters unfit for use, but south of that county wells of that or greater depth yield sodium carbonate waters of low mineral content. Many flowing wells from 300 to 800

ft. deep in the axis also yield salt water. . . . The very deep waters of the east side and of the axis increase northward in mineral content, but the shallow waters show no such general relation."

Radio-activity of spring water, R. R. RAMSEY (*Proc. Ind. Acad. Sci., 1914, pp. 453–469, figs. 7*).—This is a description of methods and apparatus used in the determination of radio-activity in water. See also a previous report by the author (E. S. R., 34, p. 332).

Water supplies to rural and small urban areas, W. G. SAVAGE (*Jour. Roy. Sanit. Inst., 36 (1915), No. 9, pp. 365–381*).—The author deals more especially with the sanitary side of small water supplies, calling attention to the results of his rather extended experience in judging the purity of water supplies, shallow wells in particular.

"It is evident that two distinct sources of pollution have to be guarded against—one the local contamination of the specific surface well, and the other the general contamination of the subsoil water. . . . If all surface wells were properly lined and made impervious to water for a depth of at least 12 ft., and were covered in to prevent pollution through the mouths of the wells, this would furnish a protection to the water quite sufficient for most country villages, unless the soil was very unsuitable for filtration purposes. . . .

"One common and widely held error is that a single water analysis, unfortified by local investigation, will enable an opinion to be given as to whether a supply is a pure one and fit for drinking purposes. . . . Water analyses only enable an opinion to be formed as to the condition of the sample submitted, and do not justify an opinion which covers the future purity of the supply. . . . The only satisfactory procedure is . . . to carefully examine the existing wells and any other sources of water supply, noting the accessibility, the depth of the subsoil water, its direction of flow (if possible), the relationship of the wells to the sources of contamination in their vicinity, the construction of the wells and how far they are built to keep out contaminating matters, the nature of the soil in which they are dug, the liability to flooding, the sufficiency of the water, and when liable to run out, etc. When this has been carried out, the wells which are best protected and from their surroundings least liable to contamination should be critically considered, and samples from these submitted for analysis to ascertain how far the subsoil water itself is polluted. With these some half-dozen samples should be sent for analysis from wells representing the average and worst conditions found from the topographical inspection."

Well waters from the trap area of western India, H. H. MANN (*Dept. Agr. Bombay Bul. 74 (1915), pp. 66, pl. 1*).—Analyses of a large number of samples of the well waters from different parts of the district are reported and discussed, with special reference to their uses for irrigation and domestic purposes.

A simple colloid-chemical process for removing micro-organisms from surface water in relation to drinking-water supplies in the field, M. STRELL (*München. Med. Wchnschr., 62 (1915), No. 34, pp. 1158, 1159, fig. 1; abs. in Chem. Abs., 9 (1915), No. 23, p. 3313*).—In this process, a black, doughy mass called humin, giving a colloidal solution with water and prepared from brown coal by treatment with hot sodium hydroxid, is added to polluted water and the mixture is treated with the solution of a metal salt, forming a flocculent precipitate containing finely suspended substances like micro-organisms, dyes, native proteins, ec.

In experiments, river water containing 84,960 bacteria per cubic centimeter was treated with 10 per cent humin solution at the rate of 5 cc. per liter of water, and the mixture then received 10 per cent aluminum sulphate solution at the rate of 2.5 cc. per liter After sedimentation and filtration the filtrate was

found to contain from 4 to 8 bacteria per cubic centimeter. A repetition of the process removed practically all the bacteria. Filtration is said to be necessary as the process does not kill the bacteria. Canton flannel is recommended for filtration.

The activated-sludge process of sewage purification, G. J. FOWLER (*Surveyor, 49 (1916), No. 1255, pp. 148–151*).—This is a summary of present knowledge of both the scientific and practical phases of the activated-sludge process of sewage purification, together with a list of 23 references to literature bearing on the subject.

Summary and latest results of experimental work on activated sludge at Milwaukee, Wisconsin, T. C. HATTON (*Engin. and Contract., 45 (1916), No. 5, pp. 104–108*).—A summary of experiments conducted since the beginning of 1914 is given, from which the conclusion is drawn that "where a high and uniform standard effluent is required no other known process equals it either in first cost or cost of operation, and where the plant is of sufficient capacity to warrant the reduction of sludge to fertilizer the sludge problem becomes solved as never before possible."

Ninth annual report of the state highway commissioner to the Governor of Virginia for the year ended September 30, 1915, G. P. COLEMAN (*Ann. Rpt. Highway Comr. Va., 9 (1915), pp. 147, pls. 26, fig. 1*).—This report deals, by counties, with road construction, expenditures, etc., in Virginia during the year ended September 30, 1915.

Methods of brick pavement construction (*Good Roads, 49 (1916), No. 6, pp. 55–61, figs. 8*).—Data obtained from inquiries addressed to a number of engineers on the so-called monolithic type of brick pavement are reported.

Forest Service proposes Douglas fir grading rule (*Engin. Rec., 73 (1916), No. 7, pp. 212, 213, fig. 1*).—A rule proposed by the Forest Service of this Department for grading Douglas fir timber for structural purposes is given. This follows the recent trend of yellow pine rules in placing in the first position clauses that determine the density of the timber. In addition to the visual inspection for density—by a rings-per-inch clause—the weighing of dried borings is provided for when the sticks do not meet the rings-per-inch rule. The plan of restricting knots, shakes, and checks in beams is also followed.

Gas tractors and their work, F. C. PERKINS (*Gas Engine, 18 (1916), Nos. 1, pp. 1–9, figs. 15; 2, pp. 61–67, 105, figs. 9*).—The details of construction, operation, and control of some of the well-known makes of gas tractors are described, special attention being called to their advantages from the farmer's standpoint.

General notes on power farming, E. R. WIGGINS (*Power Farming, 25 (1916), No. 2, pp. 22, 44*).—This paper gives information on the care of cooling systems, adjustment of farm gas engines, and use of the proper oil. Tests on four small gas engines are also reported, the purpose of which was to learn what may be expected of such engines of a given size and rating. The results are given in the following table:

Tests of small gas engines.

Rated horsepower.	Bore and stroke.	Revolutions per minute.	Piston speed per minute.	Maximum actual horsepower pulled.	Horsepower during test.	Gasoline per horsepower-hour.	Gasoline per horsepower of 10 hours.	Cooling water per 10 hours.
	Inches.		*Feet.*			*Pounds.*	*Gallons.*	*Gallons.*
1.50	3.75×5.0	500	417	1.63	1.48	1.01	1.62	3.70
1.75	3.50×5.0	550	458	1.72	1.72	.85	1.36	6.60
1.50	3.50×4.0	500	333	1.17	1.00	1.06	1.70	2.50
1.75	4.00×4.5	450	337	2.00	1.77	.76	1.21	2.82

The adjustment and operation of engine plows, C. O. Reed (*Amer. Thresherman, 18 (1916), No. 10, pp. 39, 40, 42, 43, figs. 7*).—The author deals with free-lift and unit-lift gang plows, giving information in particular regarding adjustments in assembling for average conditions, the set of coulters, and hitch and side draft.

A homemade windmill, R. H. Smith (*Rural New Yorker, 75 (1916), Nos. 4363, p. 149, figs. 2; 4364, p. 181, figs. 2*).—The details of a homemade wooden windmill are described and illustrated.

Harvesting grain in California: The combined harvester v. the grain binder, G. W. Hendry (*Univ. Cal. Jour. Agr., 3 (1915), No. 4, pp. 129–137, pl. 1, figs. 4*).—Data resulting from experience at the experimental farm at Davis, Cal., are reported, which indicate that the net returns per acre in barley production, using the binder and stationary threshing machine, were $7, against $4.16 using the combined harvester. It is pointed out that the combined system has been a salient factor in reducing the cost of grain production, but at a great sacrifice in yield. "There is a growing sentiment among farmers that the binder system is a more economical system than the combined harvester system, as measured by the net returns per acre. [This] is manifested by the fact that the number of binders used in this State is constantly increasing."

Using the modern grain separator, G. F. Conner (*Power Farming, 25 (1916), No. 2, p. 12*).—The operation and use of the labor-saving attachments, including the feeders, wind stacker, grain handlers, and dust collectors, are dealt with.

The drinking of dairy stock and automatic watering devices, O. Felix (*Schweiz. Arch. Tierheilk., 57 (1915), No. 12, pp. 651–666, figs. 2*).—The importance of clean water supplies for dairy stock is pointed out, and some automatic watering devices to be used in stalls are briefly described as both convenient and sanitary.

Experiments with aluminum milk and dairy receptacles, A. Peter (*Molk. Ztg. Berlin, 25 (1915), No. 47, pp. 369, 370; Jahresber. Molk. Schule Rütti-Zollikofen, 28 (1914–15), pp. 22–27*).—Tests of aluminum cheese tubs, milk and dairy receptacles, milk cans, and milk bowls led to the conclusions that aluminum cheese tubs may be economically used when copper becomes relatively more expensive than aluminum and that aluminum is the material most to be recommended for large milk and dairy receptacles and for milk conveyors in dairies. Aluminum is also a good material for milk bowls, but this use and the use for cheese tubs cause trouble in cleaning the walls without injuring them. It is stated that the problem of a sufficiently resistant and durable aluminum milk can has yet to be solved.

Protective paints for metal, wood, canvas, and cement roofs, F. Schrader (*Illus. Landw. Ztg., 35 (1915), No. 55, pp. 364–366*).—The proper materials and mixtures thereof for the different types of roof are pointed out.

Rural sanitation, W. B. Givens (*Fresno [Cal.] State Normal School Bul. 3 (1915), pp. 14, figs. 4*).—This briefly describes and illustrates the well-known Kentucky sanitary privy and a so-called septic tank of the multiple-chamber, continuous-flow type. The rather unusual statement is made that the tile drainage system below the tank should have a fall of from 4 to 6 in. per 100 ft. Departing further from usual practice the suggestion is made that "when the tank is completed and filled with water, five or six shovelfuls of well-rotted horse manure should be put into it to inoculate the fluid with the liquefying, purifying germs upon which everything depends."

RURAL ECONOMICS.

How the Department of Agriculture promotes organization in rural life, C. W. Thompson (*U. S. Dept. Agr. Yearbook 1915, pp. 272a–272p*).—This article gives a brief description of the activities of this Department in improving rural life through organizations, treating of the work in connection with the farm management investigations, boys' and girls' clubs, county organizations for extension activities, organizations for the introduction of special crops or for obtaining better seed, control of animal diseases, cow-testing associations, organizations for road improvement, work for improving market facilities, agricultural credit, and for the encouragement of social activities.

The author points out that "it may be noted that in every case the organization is undertaken for some specific purpose, and that that purpose is one which can better be accomplished through concerted effort than through individual action alone. This represents the general policy of the Department with regard to organization among farmers."

How Hawaii helps her farmers to market their produce, E. V. Wilcox (*U. S. Dept. Agr. Yearbook 1915, pp. 131–146, pls. 2*).—In this article is given a description of the market conditions in Hawaii and the efforts of the Hawaii Federal Experiment Station, through its marketing division, to find a market for the native produce. When the division first took up its work the town and city traders were purchasing very little native produce on account of the irregularity of receipts and lack of uniformity of packing. The marketing division sought out favorable producing centers for certain crops, taught the natives how to handle their produce, and established a market information service.

Results of this work are summarized as follows: "Starting with unorganized and isolated farming communities of different races, it has brought these men together to the mutual benefit of all concerned. Beginning with a farming population, which had been originally laborers and totally without information as to market requirements for farm products, it has brought about a striking improvement in the grading and packing of tropical fruits and products to the benefit of the farmer and of the consumer in Honolulu and on the mainland. Initiating a practical market system among a set of farmers who were thoroughly discouraged as to the prospects of carrying on general agriculture in Hawaii, it has shown that reasonable profits can be derived from diversified agriculture in Hawaii."

The cooperative purchase of farm supplies, C. E. Bassett (*U. S. Dept. Agr. Yearbook 1915, pp. 73–82, pl. 1*).—The author enumerates as the objects of cooperative purchase associations the elimination of waste in conducting their business, the securing of high-grade goods, and the standardization of supplies by using the same kind of implements, packages, etc.

The type of organization recommended is a board of five or seven directors and a secretary who is to act as business manager. It is advised that each purchaser pay in addition to a small membership fee a slight excess of the cost of the goods to cover the expenses of conducting the business. In transacting the business the association may also be used as a clearing house for orders so as to obtain carload lots. However, the author considers that it is better to give the local dealer an opportunity to bid on the purchases.

Another method advocated is to deposit in a local bank the necessary cash or arrange for the proper credit. The certificate of deposit is forwarded with the order. If warehousing or manufacturing is undertaken by the association a skillful manager is required.

The author claims that the chances for success in conducting cooperative stores are not so numerous or as great as many imagine. They should be attempted only after a most careful survey of local conditions and then only when sufficient capital and high-grade management are available. In conducting such stores, goods may be sold to the members either at cost, plus office expenses, interest, etc., or at regular retail prices. The plan of selling by regular retail prices is preferred by many because it is less disturbing to local trade and at the end of the season the profits may be divided between the member and nonmember patrons in the form of dividends.

A successful rural cooperative laundry, C. H. Hanson (*U. S. Dept. Agr. Yearbook 1915, pp. 189–194, pl. 1*).—The author states that the organization of the cooperative laundry at Chatfield, Minn., is unique in that, although a separate corporation, the laundry and the creamery have the same officers. The laundry company is organized under the cooperative laws of the State and has been capitalized at $5,000.

The creamery company owns the building, which it rents to the laundry company at $10 per month, and supplies it with power and heat at the rate of about $15 per month. The building is an addition to the creamery, 30 by 70 feet, costing about $2,000. Between and joining the two buildings are the boiler, engine, and coal rooms. This arrangement is found convenient for the operators of both plants, reduces overhead expenses, prevents contamination of cream and butter from the laundry, and is economical of heat and power. A portion of the second story has been finished off for a lunch and rest room for the employees.

"The equipment is of the most modern type, . . . cost about $3,000, is similar to that used in good city laundries, and is sufficient to turn out $400 worth of work per week.

"The charges based on weight are 5 cts. per pound, which includes the ironing of all flat work, underwear, and stockings. . . . The average cost per week for the family washing has been $1.05. Patronage is about equally divided between city and country. The laundry usually employs about 8 persons."

A graphic summary of American agriculture, M. Smith, O. E. Baker, and R. G. Hainsworth (*U. S. Dept. Agr. Yearbook 1915, pp. 329–403, figs. 82*).—These pages contain a series of graphs and maps based upon the returns of the U. S. Bureau of the Census and the Bureau of Crop Estimates of this Department, showing the geographic distribution and production of farm crops, number of farms, area of farm land, rural population, value of farm property, number of live stock, and live-stock products.

Some outstanding factors in profitable farming, J. S. Cates (*U. S. Dept. Agr. Yearbook 1915, pp. 113–120, fig. 1*).—This article contains the conclusions brought out in previous studies of the Office of Farm Management of this Department, which have been summarized as follows:

"The farming business which is of efficient size, and which is made up of diverse units, put together in such a way as to operate smoothly and well, with full employment of both labor and horse and machinery equipment, provided supervision is adequate and the enterprises making up the farm are selected wisely and are efficient, complies closely with the outstanding factors of profit. . . .

"A vast number of American farmers are making their homes on impoverished land and are practically without working capital. The outstanding factors in profitable farming, in such cases, consist in a study of what to do with what they already have. The factors of profit must be toned down to terms of expediency under existing conditions."

Unprofitable acres, J. C. McDowell (*U. S. Dept. Agr. Yearbook 1915, pp. 147–154, pls. 4*).—Among the causes for unprofitable acres are mentioned that the area cultivated by a farmer may be too small to give him profitable employment, or the area may be so large that the farmer can not cultivate the land to the best advantage; the holding of land capable of profitable agricultural use out of cultivation for land speculation; and the prohibitive cost or lack of capital to properly drain land or clear it of stumps, stones, etc.

The author summarizes his article as follows: "To meet the growing demand for farm products we must farm more acres or make each acre produce more. Land not now in farms should be made into farms, and unimproved land now in farms should be improved, only in so far as this can be done profitably."

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt. 2 (1916), No. 4, pp. 29–40, figs. 2*).—This number estimates the condition of winter wheat and rye on April 1, the condition of farm animals on the same date and losses during the previous year, prices paid to producers of farm products, estimated farm value of important products on March 15 and April 1, range of prices of agricultural products at important markets, the final estimate of the United States beet sugar production, maple sugar and sirup production in Vermont, the production of important crops in the leading five States during 1913–1915, a special report on the condition of truck crops and the early potato crop, and miscellaneous data.

An estimate of the apples harvested by months showed that 3 per cent is harvested in June, 11 per cent in July, 15 per cent in August, 26 per cent in September, and 45 per cent in October.

An inquiry sent to flour mills and grain elevators is summarized as follows: Of the 1915 wheat crop, 14.4 per cent was unfit for milling and 7.3 per cent was used for feed. About 4 per cent is usually fed.

An inquiry into the causes and extent of live-stock losses indicated that the anual loss of cattle from disease amounts to $177,750,000, swine $66.466,000, and sheep $21,184,000. The following table gives the percentage of loss by causes:

Estimated annual live-stock losses in the United States, by causes.

Cause of losses.	Cattle.	Swine.	Sheep.
	Per cent.	*Per cent.*	*Per cent.*
Hog cholera	0.0	48.9	0.0
Texas fever and cattle tick	5.9	0.0	0.0
Tuberculosis	10.8	2.6	2.4
Contagious abortion	9.2	0.9	2.0
Blackleg	15.5	0.0	0.2
Scabies	0.7	0.0	7.3
Internal parasites	3.0	10.4	13.0
Anthrax	1.7	0.2	0.5
Exposure	12.2	8.2	22.1
Insufficient or irregular feeding	15.3	10.0	13.7
Predatory animals	2.4	1.1	18.1
Miscellaneous live-stock diseases	23.3	17.7	20.7
Total	100.0	100.0	100.0

Information is given concerning apple production and value, showing that there were 76,350,000 bbls. of apples produced in 1915, of which 49,487,000 were sold at an f. o. b. price of $1.78 per barrel. A table is included showing the distribution by varieties.

A special inquiry as to the changes in value of farm lands indicates that the value of farm lands in the United States in 1915 was $45.55 per acre, compared with $40.85 for the year previous. The census reported the value of farm lands

in 1910 as $32.40, and in 1900 as $15.57 per acre. It is stated that the percentage increases in farm-land values since 1912 are as follows: North Atlantic States, 17 per cent; eastern part of North Central States, 20 per cent; western part of North Central States, 28 per cent; South Atlantic States, 23 per cent; South Central States, 25 per cent; far Western States, 34 per cent; entire United States, 25.7 per cent.

The production of durum wheat in Minnesota, North Dakota, and South Dakota, the States producing about 95 per cent of the entire crop of durum wheat, was 37,900,000 bu., with an average yield of 19.3 bu. per acre, and an average value per acre of $20.77. The average yield for other types of wheat in the same States was 17.4 bu., and the average value, $20.04.

AGRICULTURAL EDUCATION.

The development of the Philippine Islands, H. J. Waters (*Manila: Bureau of Printing, 1915, pp. 45*).—This is a summary of the results of a personal study of the natural resources of the country, the development and work of the schools, and the agricultural practices of the people of the Philippine Islands.

The author briefly outlines the work of the six governmental agencies that are giving instruction in agriculture or engaged in agricultural development, viz, the bureaus of agriculture, education, forestry, and science, and the colleges of agriculture and veterinary medicine, indicating extensive duplication, some of which is deemed economical and justifiable and some unnecessary and wasteful. Recommendations are made for combining the work of these various agricultural agencies and correlating with it the work of the bureau of education, not so much upon the grounds of economy of administration as upon the broader grounds of greater efficiency.

He suggests that while the bureau of education conducts elaborate crop tests in all the provinces and is accumulating valuable data regarding the behavior of these crops under different conditions of soil and climate, this work should be inspected or studied by a representative of the agricultural institutions, not with any idea of controlling it but with a view of making it successful and most helpful to the school children and farmers. It is his opinion, on the other hand, that the bureau of education should not assume that knowledge of agriculture which would justify its officers in recommending a practice for any region or in putting such practice into effect through its schools and school gardens, as it is the function of the bureau and college of agriculture to shape the agricultural policies of the islands as definitely as it is that of the bureau of education to shape their educational policies.

As regards the college of agriculture the author finds the departments of botany and chemistry exceptionally well organized and officered and comparing favorably with those of the better colleges of the United States, but that in the practical subjects the college is not so far advanced. He believes that by adding two years of agriculture, viz, a strong and closely supervised course of five hours in farm practice in the first year of the curriculum and a full course in agriculture, dealing with the staple crops and laying emphasis upon plant judging and selection in the second year, and by giving three courses instead of two in animal husbandry, the course would be fairly well balanced for the present. He holds that no matter what is finally done regarding the merging of a part of the work of the college of agriculture with that of the bureau of agriculture, the duty of the college to do research work must be clearly recognized and the necessary funds provided.

Agricultural instruction in Surinam, J. J. Leys (*Jour. Bd. Agr. Brit. Guiana, 9 (1915), No. 1, pp. 11–14*).—This is a description of two-year agricul-

tural courses of 40 weeks each, with a three-hour lecture a week, for young farmers and teachers. Theoretical instruction is given in chemistry, botany, zoology, and physics, and practical knowledge in the tilling of the soil, the use of agricultural tools, drainage, manuring, cattle rearing, dairy work, and the cultivation of agricultural plants adapted to local conditions. The minimum age at which pupils are admitted is 15 years.

Elementary courses were started in March and secondary courses in May, 1915. Agricultural instruction in Surinam is entirely separate from elementary education and is under the supervision of the director of agriculture.

Horticultural winter schools, H. R. Jung (*Gartenflora, 65 (1916), No. 1-2, pp. 14-18*).—To meet the need of better facilities for elementary horticultural instruction in Germany, the author recommends the establishment of horticultural winter schools in connection with the agricultural winter schools, and outlines suggested regulations, subject matter, and a weekly schedule of hours for such schools.

Report of the work of the School Garden Association in 1913 and 1914 (*Ber. For. Skolehav. Virks. [Denmark], 1913-14, pp. 31, figs. 17*).—This report contains a summary of the school garden work in Denmark in 1913 and 1914, followed by brief reports on the work of several of the 70 individual gardens now there.

Regulations for grants in aid of agricultural education and research in England and Wales, 1916-17 (*London: Bd. of Agr. and Fisheries, 1915, pp. 22*).—This pamphlet deals with the conditions under which grants are awarded through the Board of Agriculture and Fisheries from the Development Fund or parliamentary appropriations.

Second thousand answered questions in California agriculture, E. J. Wickson (*San Francisco: Pacific Rural Press, 1916, pp. 254*).—These questions and answers relate to fruit and vegetable growing, grains and forage crops, soils, fertilizers, irrigation, live stock and dairying, feeding animals, diseases of animals, poultry keeping, and pests and diseases of plants. The book is a sequel to One Thousand Questions in California Agriculture Answered (E. S. R., 31, p. 494), and avoids duplication of the preceding volume.

Elementary vocational agriculture for Maryland schools, E. A. Miller (*Md. Agr. Col. Bul., 12 (1915), No. 8, pp. 222, figs. 70*).—This is the complete series of monthly publications, from September to May inclusive, setting forth lessons in elementary vocational agriculture, outlined after a monthly sequence plan, and adapted to the seasonal, agricultural, and school conditions of Maryland, of which the first issue has been noted (E. S. R., 33, p. 695). The lessons treat of the following subjects: The soil, crops, the orchard, vegetable, fruit, and flower gardening, poultry, dairying, farm animals, buildings for farm animals, farm accounts, insects, plant diseases, silage, rope—knots, hitches, and splices, nature study, school ground improvement, and management suggestions. Each lesson comprises classroom work, practical exercises consisting largely of club activities and home projects, suggested correlations, and references to the literature.

Extension course in soils for self-instructed classes in movable schools of agriculture, A. R. Whitson and H. B. Hendrick (*U. S. Dept. Agr. Bul. 355 (1916), pp. 92*).—This course is designed to aid agricultural colleges in their extension work and is intended for the use of small groups of farmers assembled as a class to study the subject in a systematic manner, with one of their number as leader. An entire day is to be consumed by each of the 12 lessons, the forenoon being devoted to the subject matter and reference work and the afternoon to the practical exercises outlined. Reference books, apparatus, and supplies are listed in an appendix.

Suggestions for school and home projects in agriculture, K. L. HATCH and W. F. STEWART (*Bul. Univ. Wis., No. 757 (1916), pp. 30, figs. 6*).—This bulletin contains an outline of the purpose, aims, scope, and method of practical projects in the study of elementary and secondary agriculture; suggested outlines for a series of projects in dairying and orcharding, developing from the simple to the complex and illustrating the logical sequence of projects, and including short, medium, and long-time projects; suggested titles for a series of projects in corn growing; and a classified list of suggested short, medium, and long-time projects.

Practical examples in dairy arithmetic, H. E. ROSS, E. S. GUTHRIE, and W. W. FISK (*Cornell Reading Courses, 5 (1915), No. 98, pp. 24, figs. 4*).—Specific examples are given to show the farmer and the factory man how various computations required in dairy practice are made. In many cases the problems are based on figures taken direct from creamery records.

How the whole county demonstrated, B. KNAPP and J. M. JONES (*U. S. Dept. Agr. Yearbook 1915, pp. 225–248, pls. 2, figs. 2*).—An account is given of the difficulties encountered, methods employed, and results accomplished by county demonstration agents in the evolution of the rural life of Christian County, Ky., and Culpeper County, Va.

The boys' pig club work, W. F. WARD (*U. S. Dept. Agr. Yearbook 1915, pp. 173–188, pls. 6*).—The author discusses the objects and plan and some results of pig club work, the financing and subsequent careers of club members, prizes awarded, exhibits at county and state fairs, the home curing of pork, and the beneficial influence of pig club work on the boy.

The poultry club work in the South, R. R. SLOCUM (*U. S. Dept. Agr. Yearbook, 1915, pp. 195–200, pls. 3*).—The objects and methods of poultry club work in the South, work of the poultry club agents, community breeding, school poultry flocks, growth of the work in three years, and some results are discussed.

MISCELLANEOUS.

Yearbook of the Department of Agriculture, 1915 (*U. S. Dept. Agr. Yearbook, 1915, pp. 616, pls. 76, figs. 96*).—This contains the report of the Secretary of Agriculture, previously noted (E. S. R., 35, p. 94); 24 special articles abstracted elsewhere in this issue; and an appendix containing a directory of the agricultural colleges and experiment stations and the state officials in charge of agricultural work, and statistics of the principal crops, farm animals and their products, the federal meat inspection, estimated value of farm products, tonnage carried on railways, 1912–1914, imports and exports of agricultural products, rural and agricultural populations, number of persons engaged in agriculture and area of agriculture land in various countries, and the utilization of the National Forests.

Annual report of the director for the fiscal year ending June 30, 1915 (*Delaware Sta. Bul. 111 (1916), pp. 31*).—This contains the organization list and the report of the director on the work and publications of the station. It includes a financial statement for the fiscal year ended June 30, 1915.

Getting the most out of farming, D. WALLACE (*St. Paul, Minn.: Author, 1916, pp. 128*).—"A selected list of publications, of value to the farmer and farmer's wife, available for free distribution by the government and state experiment stations."

What shall the farmer read? F. H. HALL (*N. Y. Dept. Agr. Bul. 75 (1915), pp. 2559–2590*).—A classified list of books for the farm library is given, together with a discussion of the subject.

NOTES

California University and Station.—Plans are nearing completion for Hilgard Hall, the new reinforced concrete building about to be built on the university campus at a cost of $350,000, and a wing of the present agricultural building. This expense is to be defrayed from the proceeds of the $1,800,000 of building bonds authorized by the people of California through approval of an initiative measure proposed by the alumni of the university. The other buildings being erected from this initiative bond issue are Benjamin Ide Wheeler Hall, a granite classroom building, to cost $700,000, which will accommodate 3,500 students at one time, and will contain also 47 studies for professors and a lecture room seating 1,090 people; the first unit of a new group of permanent buildings for chemistry, this first building to cost $160,000; the completion of the university library, on which $850,000 has already been spent, and on which an additional $525,000 is now to be expended; and a second unit for a central heating and power plant, to cost $60,000, and to increase the supply of heat and light so as to provide for these new buildings.

A contract for about $100,000 has been let for the new buildings at the citrus substation at Riverside. The principal building is to consist of a two-story and basement center, 154 by 57 feet, with one-story wings each 100 by 55 feet. This structure is to provide extensive laboratory and office facilities. The center is to be used for administration, the library, a lecture room, and laboratories for entomology, plant breeding, soils, and orchard management, and one of the wings for plant pathology and plant physiology and the other for agricultural chemistry.

A director's residence, barns, and other buildings are also being erected under a $25,000 appropriation. About 125 acres have been planted to grain to test the uniformity of the soil of the new site, and about 10 acres have been set out to apricots and pears as a part of a series of experiments on the principles of pruning.

The last annual farm picnic at Davis was attended by about 16,000 people, this being about three times the number on any previous occasion.

Edward P. Van Duzee has resigned as instructor and assistant in entomology to accept an appointment as curator of the department of entomology of the California Academy of Sciences.

Illinois Station.—Dr. A. D. Emmett, assistant chief in animal nutrition, has accepted the position of research biological chemist with a commercial firm at Detroit, Michigan, beginning September 1.

Mississippi College.—W. H. Smith, state superintendent of education, has been appointed president, vice George R. Hightower, beginning September 15.

Montana College and Station.—Leave of absence, terminating June 1, 1917, has been granted to H. E. Morris, assistant botanist, and E. J. Quinn, assistant chemist, for advanced study. Dr. E. H. Riley, assistant professor of animal husbandry, has resigned to devote his entire time to the work of the State Stallion Registration Board. R. C. McChord, instructor in animal husbandry in Purdue University, has been appointed assistant professor of animal industry.

Dr. W. E. Joseph, associate animal husbandman at the Illinois University and Station, has been appointed assistant animal husbandman, vice R. R. Dodderidge, whose resigntion has been previously noted.

New York State College and Stations.—Owing to a veto by Governor Whitman of the legislative printing appropriation bill, carrying a lump fund of about $200,000, no state appropriation for printing the station bulletins and reports is available. The Cornell and State stations have each been receiving about $60,000 per annum from this fund. The veto followed a refusal by the legislature to itemize the objects of expenditure.

North Carolina Station.—A campaign to stimulate interest in building silos in the Piedmont section of the State has been begun. A campaign is also under way to induce the patrons of creameries to have their children compete for about $800 worth of prizes offered by the creameries for the best set of herd records kept for the year beginning July 1. About 100 entries for this contest have been obtained.

The division of markets is assisting the potato growers of the northeast section of the State through a wire service inaugurated in cooperation with the Office of Markets and Rural Organization of this Department, a saving to these growers of several thousand dollars being estimated. A similar service is being rendered to the cantaloup growers in the Sandhill section around Laurinburg.

Ohio State University.—Dr. Jay B. Park has been appointed professor of farm crops. He was associated for two years with the department of agronomy at the Illinois Station, and since that time has been studying plant breeding at Harvard University, from which he received his doctor's degree this spring.

Alfred C. Hottes, instructor in floriculture in Cornell University, has been appointed assistant professor of horticulture. His special work will be the developing of courses in floriculture.

Oklahoma College.—James A. Wilson, a former director of the station, has been placed in charge of extension work, vice W. D. Bentley, resigned to accept an appointment with the Office of Extension Work in the South, of the State Relations Service of this Department.

Hampton Institute.—R. W. Crouse and Louis Martin, instructors in agriculture, resigned July 1, the former to manage a farm in Iowa, and the latter to take charge of demonstration work among the negroes in Maryland. Dr. R. R. Clark, veterinarian and instructor in animal industry, resigned August 1 to become principal of the Theodore N. Vail Agricultural School at Lyndon, Vermont. J. L. B. Buck and A. E. Shipley, assistant and secretary to the director, have been given indefinite leave of absence for service in the Army in connection with the Mexican situation. Recent appointments include Floyd Crouse, J. R. Case, and J. M. MacIntosh, 1916 graduates respectively of the Iowa, Connecticut, and Ontario colleges, as instructors in farm crops, elementary agriculture, and farm physics.

Vermont University.—Miss Josephine A. Marshall, assistant professor of home economics, has accepted a position with Teachers' College of Columbia University.

Agriculture at the National Education Association.—According to *The American Review of Reviews*, the association "has not often given so much of its time to the country school and rural conditions as it did this year." At the meeting held at New York City, July 1 to 8, the fundamental line of thought in several departments was that the country school of all rural social institutions makes the best and most available center for rebuilding the rural community, and bears at present the greatest responsibility for socializing country life. The address of the president, Dr. David B. Johnson, of South Carolina, was

a plea for a national commission to study the farm home and the farm woman, and a resolution requesting President Wilson to appoint such a commission was adopted by the association.

In a paper before the Department of Rural and Agricultural Education, M. C. Burritt, state leader of farm bureaus for New York, enumerated as among the fundamentals in agricultural extension to-day the following: (1) Local responsibility for and partnership in any plan for the education of adult farmers and the development and organization of rural communities is essential. This may be obtained through a county farmers' association which has joint power and responsibility with the representative of the agricultural college in the management of the work. (2) The most efficient way to work in a specific community is through a community group and through local workers, as through a county advisory council with representatives in each community. (3) If the work is to be permanent, local initiative must be encouraged and developed and local leadership further trained and connected up with individuals of organizations in such a way that the work will be continuous and effective. This may also be done through the advisory council. (4) Experience indicates that the most effective method of teaching the best agricultural science, practice and organization, is that of the "demonstration." This is worked out in the farm bureau movement in New York State through local cooperators and the advisory council.

Field Exercises in Their Relation to Agricultural Teaching was the title of a paper by K. C. Davis, in which he maintained that agriculture must be kept a practical subject. Although agriculture is founded on both practice and science, he held that there is danger that in an effort to make agriculture a culture subject many schools will fail to maintain the practical side. The more practical phases may be given to the students through field exercises with soils, crops, orchards, live stock, machinery, etc., and through laboratory exercises, school and home demonstrations, and school and home projects. When the values of these methods of training and instruction are neglected the instruction may become too theoretical and too abstract and receive the criticism of being bookish. The paper suggested many concrete examples of field exercises, among them the identification of annual weeds in cultivated fields, making a school collection of ripe weed seeds, laying out drainage lines, collecting and studying nodules on roots of legumes, mapping, replanning, and remapping the farm, determining the expense for extra fencing on a poorly planned farm, comparing several farms with reference to methods or places for starting fruits, root crops, corn, small grain, and other staple products, and comparing farms in regard to the benefits of shrubbery, vines, and flowers used in beautifying the grounds.

L. H. Dennis spoke on The Home Project in Secondary School Agriculture, concluding that "the home project is an integral part of the scheme to furnish specific preparation for life on the farm. . . . To eliminate the home project from the vocational agricultural course would be equivalent to removing the means whereby theory and practice meet. While the home project idea has already been extensively developed, its possibilities have by no means been exhausted."

E. M. Tuttle described Rural School Extension Work by the New York State College of Agriculture. This now embraces the department of rural education, the publication of the Cornell Rural School Leaflet, and the junior home project work, begun within the past year, and directed exclusively by the educational authorities with the cooperation of other agencies.

Officers of this department of the association elected for the ensuing year include W. H. French, Michigan Agricultural College, president; Z. M. Smith,

Indiana State Department of Public Instruction, vice-president; and C. H. Lane, U. S. Department of Agriculture, secretary.

Among the organizations meeting with the National Education Association was the School Garden Association of America. The Relation Between School Gardens and Home Gardens was considered by L. A. DeWolfe, who reported that in Nova Scotia the school garden has not yet helped the home garden so much as it should since the school garden is still too often regarded as unnecessary or even detrimental to school work. "Nevertheless, the school garden has its place. It is the demonstration ground where principles to be applied to the home garden are taught. When the children see celery planted, or proper transplanting done, they can go home and do likewise. But no amount of telling will give them the courage to try."

In the paper by Caro Miller entitled Gardening in the City Schools of Tomorrow, she said that the formal restricted school gardening of yesterday and to-day is gradually giving way to a broader treatment of gardening from the standpoint of a vocation and an avocation.

"We may expect gardening in the city schools of to-morrow to develop along these lines: (1) Systematic training of all city normal school students in the theory and practice of gardening, (2) the widest use of the formal school garden through the school day by visiting classes, from the kindergarten to eighth grade, for practical work on a class plat and theoretical lessons from a progressive graded course of study, (3) home gardens supervised by paid trained teachers after school and during vacation, (4) vacant lots used as supplements to home gardens, (5) agricultural clubs for home project work, (6) well-organized fall exhibits of home and school garden products, (7) decorative plantings on school grounds which shall be truly a model for the neighborhood, (8) systematic planting and expert care of trees and vines for all schools, and (9) elective courses in general agriculture and horticulture offered in all high schools."

S. B. McCready read a paper on Ideal Gardens for Country Schools. He pointed out that ideal gardens presuppose ideal conditions, such as a permanent teacher interested in her community and believing in the power to affect human lives through gardening; an interested community intent on progress, loyal to their teacher and realizing that in the interests awakened in their boys and girls lie their best satisfactions; a loyal band of boys and girls not afraid of work, willing and desirous to help make the school attractive; and a school property worth improving and possible to improve, having good soil, etc.

Ellen Eddy Shaw read a paper on What Can a Botanic Garden Do to Help School Gardens? This consisted largely of a review of the work of the Brooklyn Botanic Gardens through regular garden instruction, cooperation with the schools in their nature and geography work, and courses given to teachers in garden work and in botanical nature work.

Association of Agricultural College Editors.—This association met for its fourth conference at the Kansas College, June 21–23, with representatives of about fifteen States and this Department. An address of welcome was given by President H. J. Waters, in which he advocated as the ideal qualification for college editors, training in agriculture and journalism, together with newspaper and farm experience. An exhibit of bulletins and press material formed a special feature of this meeting.

Officers were elected as follows: President, W. C. McClintock, director of publications in the Ohio State University; vice-president, N. A. Crawford, professor of industrial journalism in the Kansas College; secretary-treasurer, Dr. B. E. Powell, director of information in the University of Illinois; and additional members of the executive committee, H. B. Potter and W. C. Palmer,

editors respectively of the University of Tennessee and the North Dakota College.

Federal Aid in Rural Post Road Construction.—An act approved July 11 authorizes the Secretary of Agriculture to cooperate with the States through their highway departments in the construction of rural post roads. An appropriation of $5,000,000 is made for the fiscal year ending June 30, 1917, $10,000,000 for 1918, $15,000,000 for 1919, $20,000,000 for 1920, and $25,000,000 for 1921, to carry out the Act. Not to exceed three per cent of the appropriation for a year may be used for administrative purposes, and the remainder is to be apportioned among the States. The basis of apportionment is as follows: One-third in the ratio which the area of the State bears to the total area; one-third in the corresponding ratio as to population; and one-third in the ratio which the mileage of rural delivery and star mail routes in a State bears to the total mileage on such routes.

Projects must be submitted to the Secretary of Agriculture for all roads to be constructed, and upon his approval not to exceed fifty per cent of the cost may be expended as the share of the Federal Government. Construction is to be under the supervision of the state highway departments, but subject to the inspection and approval of the Department. The States must maintain all roads constructed under the Act, and may be debarred from further participation in its benefits until roads have been put in proper condition.

An appropriation for $1,000,000 per annum for ten years is also made available for the construction of roads and trails wholly or partly within the National Forests. These roads will subsequently be maintained upon a cooperative basis. Expenditures under this provision are to be reimbursed from the revenues of the National Forests.

Cooperation with the United States Department of Agriculture.—A recent issue of the *Weekly News Letter* announces that nearly 770,000 persons are now aiding this Department as cooperators without compensation. This service is being rendered mainly by furnishing information, demonstrating the local usefulness of new methods, and the like. There are also 4,560 weather observers, 15,000 railroad agents reporting shipments of perishable crops to be used in the market news service, and many other trade agencies. It is estimated that at least one farm in every twenty is working in some way with the Department, and thousands of others are rendering similar service to the agricultural colleges and experiment stations.

Miscellaneous.—A tablet, presented by the Guernsey Breeders' Association, was unveiled June 20 at the University of Pennsylvania in memory of the late Dr. Leonard Pearson, formerly professor in the university veterinary school and dean of the faculty.

The Yorkshire Agricultural Union has decided to raise a national fund for the representation of agriculture in the British Parliament by practical farmers.

The Cresson Types of Hymenoptera, by Ezra Townsend Cresson, constitutes No. 1 of the Memoirs of the American Entomological Society.

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EXPERIMENT STATION RECORD.

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EXPERIMENT STATION RECORD.

VOL. 35. ABSTRACT NUMBER. No. 3.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Annual reports on the progress of chemistry for 1915, edited by J. C. CAIN, A. J. GREENAWAY, and C. SMITH (*Ann. Rpts. Prog. Chem.* [*London*], *12* (*1915*), *pp. VIII+268, figs. 6*).—This report deals with the progress made during the year 1915 in the subjects listed in reports previously noted (E. S. R., 35, p. 8).

The preparation and composition of caseinogen, J. MELLANBY (*Biochem. Jour., 9* (*1915*), *No. 3, pp. 342–350*).—The author uses the word caseinogen to denote the main protein present in milk; acidic caseinogen, the protein precipitated from milk by acid; and casein, the protein precipitated from milk by the action of proteolytic ferments and calcium salts.

A method for the precipitation of caseinogen from milk by alcohol is described in detail, together with experimental data as to the calcium and phosphorus content of caseinogen and of acidic caseinogen.

The results of the analyses of caseinogen and acidic caseinogen indicate that caseinogen is composed of a complex of one unit of protein and a molecule of tricalcium phosphate. The precipitation of acidic caseinogen from caseinogen by acetic acid is expressed by the formula

$$\underset{\text{(caseinogen)}}{\text{Protein, }Ca_3(PO_4)_2}+6H\bar{A}=\underset{\text{(acidic caseinogen)}}{\text{Protein, }6H\bar{A}}+Ca_3(PO_4)_2.$$

A note on iodized protein, A. OSWALD (*Hoppe-Seyler's Ztschr. Physiol. Chem., 95* (*1915*), *No. 5–6, pp. 351, 352*).—The author describes a procedure for the preparation of an iodized casein. This contains 14.39 per cent iodin, is pure white in color, and is not affected by the action of even the direct rays of sunlight.

A colorimetric method for the estimation of amino-acid α-nitrogen.—II, Application to the hydrolysis of proteins by pancreatic enzyms, V. J. HARDING and R. M. MACLEAN (*Jour. Biol. Chem., 24* (*1916*), *No. 4, pp. 503–517, figs. 8*).—The colorimetric method previously described (E. S. R., 34, p. 505) has been experimentally applied to a study of the rate of proteoclasis of casein, serum albumin and globulin, peptone, nucleoprotein, gluten, fibrin, and gelatin by pancreatic enzyms. The results were compared with those obtained by the Sörensen and Van Slyke methods, and agreed very well with those from the Van Slyke but not from the Sörensen method.

The composition of "lecithin," together with observations on the distribution of phosphatids in the tissues and methods for their extraction and purification, H. MACLEAN (*Biochem. Jour., 9* (*1915*), *No. 3, pp. 351–378*).—Phosphatids extracted from tissues by alcohol invariably contain large amounts of a nitrogenous impurity which is very difficult to remove by any of the

ordinary methods of preparation. This material is very complex chemically and contains bodies of a purin nature. All the nitrogen of lecithin is accounted for by the cholin and amino nitrogen present.

By fractionation of the cadmium chlorid salt lecithin can be separated into two components (true lecithin and kephalin). True lecithin contains all of its nitrogen in the form of cholin, while the kephalin fraction contains only a part as cholin and the greater part as amino-ethyl alcohol.

Procedures for the extraction and purification of the phosphatids and also for the determination of cholin are discussed.

On certain constituents of the germinating maize, E. WINTERSTEIN and F. WÜNSCHE (*Hoppe-Seyler's Ztschr. Physiol. Chem., 95 (1915), No. 5–6, pp. 310–336*).—Experimental results have shown that the constituents of the germinating maize are, in many respects, different from those of the germinating wheat. The crystalline nitrogenous substances (protein cleavage products) isolated from the germinating wheat could not be found in the maize.

In the two samples examined no arginin could be isolated and only traces of glutamin. Guanidin, however, was found to be present, together with a base of unknown constitution. Hordenin (parahydroxyphenylethylamin) was also found in the maize embryo. It is possible that the amino acids carried to the maize embroyo are used immediately in constructing the protein mole cule, while in the wheat embryo there is a partial accumulation of these products. Whether or not the guanidin is found as an intermediate product of the protein synthesis is doubtful.

It is of interest to note that in the autolysis of the maize embryo in vitro only a small amount of protein cleavage is apparent. In the hydrolysis of the isolated proteins the usual amino acids were found. A large amount of water-soluble protein with a small amount of globulin constituted the protein found in the maize embryo. No nucleic acid could be isolated.

The fat content of the maize was found to be about four times as great as that of the wheat. The fat contained solid and liquid fatty acids, together with sitosterin and phosphatids.

A glucosid was also found, together with pentoses which were probably split from pentosans during the autolysis, and a considerable amount of inosit phosphoric acid.

The occurrence of sucrose in grapes of American origin, H. C. GORE (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 333, 334*).—An examination of 66 varieties of American grapes during four successive seasons showed that 43 of them contained no sucrose, 10 contained sucrose occasionally, and in 13 varieties it was frequently present.

It is indicated that sucrose should be regarded as a normal constituent of many varieties of grapes of American origin.

The occurrence of sucrose in relatively large amounts in a new seedling grape, W. B. ALWOOD and J. R. EOFF, JR. (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 334, 335*).—The authors submit analytical data of a seedling grape of unknown origin in various conditions. The data include the specific gravity, total solids, sugar-free solids, invert sugar, sucrose by inversion, total sugar as invert, and total acid as tartaric.

The acetone content of milk, N. O. ENGFELDT (*Hoppe-Seyler's Ztschr. Physiol. Chem., 95 (1915), No. 5–6, pp. 337–350*).—A summary of the analytical data submitted shows the acetone content of cow's milk to vary between 1.45 and 2.42 mg. per liter, with an average of 1.85 mg. for ten determinations. The total quantity per day varied, and seemed to be in direct relation to the quantity of milk produced. The age of the animal, the stage of lactation, and

the conditions of pregnancy seemed to have no influence on the acetone content of the milk.

The quantity present in mare's milk varied between 0.48 and 0.97 mg. with an average of 0.71 mg. per liter in five determinations. In ewe's milk for five determinations the variation was found to be between 0.48 and 0.68 mg., with an average of 0.56 mg. per liter. The amount in goat's milk varied from 0.97 to 1.45 mg., with an average of 1.07 mg. per liter for six determinations. Unilateral thyroidectomy had no influence on the acetone content of the milk. In human milk the variations were found to be between 0.48 and 1.16 mg. per liter.

The procedure used by the author for the determination of the acetone was to precipitate the protein of the milk with a 10 per cent solution of tannic acid, then distill the acetone in the usual manner, and titrate with a standard iodin solution, using a finely calibrated burette.

Studies on the reducing properties of milk, J. Samšula (*Wiener Tierärztl. Monatsschr., 2 (1915), No. 12, pp. 545–552*).—The author has repeatedly observed that if two samples of middle milk are drawn from any quarter of the udder of a healthy cow, the one in a sterile container and the other simply in a clean container, both samples will decolorize methylene blue in the same period of time. After being kept at room temperature, however, for about eight hours the sterile sample will decolorize methylene blue much sooner than the other sample. The difference in time of decolorization is considerable and not easily explained.

It is indicated that the bactericidal property of milk probably plays a rôle in the phenomenon, and that by its activity it destroys the reducing enzym.

The analysis of waxes with special reference to beeswax and wool wax, F. W. Richardson and G. A. Bracewell (*Jour. Soc. Chem. Indus., 35 (1916), No. 3, pp. 160–163*).—The following average values, obtained from the analyses of three samples of beeswax, are submitted: Unsaponifiable matter—Hübl iodin value, 8.06; butryo-refractometer at 75° C., 21.3; refractive index at 75°, 1.4386. Saponifiable matter—melting point, 53.9°; butyro-refractometer at 50°, 31.1; refractive index at 50°, 1.446; calculated butyro-refractometer at 75°, 15.6; Hübl iodin value, 11.9.

The average composition of wool wax obtained is given as follows: Saponifiable matter—free fatty acids, 2 per cent; neutral esters, 56 per cent. Unsaponifiable matter—42 per cent. The wax itself has the following values: Hübl iodin value, 25; acid value, 4; butyro-refractometer at 50°, 76. Fatty acids in the saponifiable matter: Hübl iodin value, from 8.5 to 10; melting point, 42°; butyro-refractometer at 50°, 45; neutralization value, from 136 to 150. The unsaponifiable matter has a refractive index of from 1.489 to 1.495, Hübl iodin value of from 40 to 50, and acetyl saponification value of 135.

The analytical procedures used in separating the saponifiable and unsaponifiable matter are outlined in detail. Other analytical methods are also described.

Researches on the nature of enzym action.—IV, The action of insoluble enzyms, W. M. Bayliss (*Jour. Physiol., 50 (1915), No. 2, pp. 85–94*).—Continuing work previously noted on the nature of enzym action (E. S. R., 31, p. 608), it has been shown that urease, lipase, emulsin, invertase, lactase, papain, peroxidase, and catalase are active in media from which they can be filtered by ordinary filter paper, while the filtrates are inactive. Suspensions of solid preparations of pepsin and trypsin in strong alcohol are decidedly more active than the filtrates of such saturated solutions. These enzyms seem to be able to assume a colloidal state in such solutions to a small degree and thus to exhibit a slight activity.

"Enzymic activity is thus manifested at the interface of contact between the solid enzym phase and the liquid substrate phase. The catalysts concerned are not in true solution."

I, The relation of hydrogen ion concentration of media to the proteolytic activity of Bacillus subtilis. II, Proteolysis of Streptococcus erysipelatis and S. lacticus compared under different hydrogen ion concentration, A. ITANO (*Massachusetts Sta. Bul. 167 (1916), pp. 139–185, figs. 6*).—The bacteriological value of Sörensen's method for the study of proteolysis in conjunction with variations in the hydrogen ion concentration has been determined, the organism *B. subtilis* being used in the investigation. It was shown that certain hydrogen ion concentrations measure the exact influence, both inhibitory and prohibitory, and indicate the exact limits of the proteolytic activity of the micro-organism. With increasing proteolysis the hydrogen ion concentration of the medium converges toward the optimum. The results indicate that *B. subtilis* produces endoenzym and no exoenzym. Sörensen's method yielded very satisfactory results in determining the rate of proteolysis. For obtaining any desired hydrogen ion concentration in a medium the colorimetric method was used.

The apparatus and technique employed in the investigation are described in detail. A review of the earlier literature on the subject is also included.

Part 2 deals with the application of the method developed in the investigation to a study of *S. erysipelatis* and *S. lacticus*. The virulent strain of *S. erysipelatis* was found to multiply much more rapidly in a broth medium than the nonvirulent strain, *S. lacticus*. A difference both in degree and rate of proteolysis was evident, *S. erysipelatis* being much more active and vigorous. The results indicate a very close relationship between the optimum hydrogen ion concentration for proteolysis (in the bouillon) and the hydrogen ion concentration of the natural environment of the organisms (blood and milk).

The general applicability of the paper pulp filter to quantitative analysis, S. L. JODIDI and E. H. KELLOGG (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 317–319*).—Experimental data submitted indicate that the application of the pulp filter to the quantitative estimation of barium and sulphuric acid as barium sulphate, of silver and hydrochloric acid as silver chlorid, and of potassium and ammonium as chloroplatinate gives results as accurate as those obtained by the use of standard filter paper. See also a previous note (E. S. R., 34, p. 712).

A simple apparatus for filtration under diminished pressure, J. C. IRVINE (*Biochem. Jour., 9 (1915), No. 3, pp. 321, 322, fig. 1*).—An apparatus is described in which a specially designed cylindrical tube is used instead of an ordinary suction flask for filtration under diminished pressure. The apparatus is deemed of special value when manipulating small quantities of material in that it obviates undue loss in transferring the material to another container.

Color standards and colorimetric assays, H. V. ARNY and C. H. RING (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 309–317*).—The preparation of color standards for ammonia, nitrate, nitrite, vanillin, uric-acid, salicylic-acid, and phosphate colorimetric procedures is described in detail. The solutions used for making standard blends are divided into three series, viz, cobalt-iron-copper, cobalt-chromium-copper, and chromium-manganate.

Some indicators from animal tissues, W. J. CROZIER (*Jour. Biol. Chem., 24 (1916), No. 4, pp. 443–445*).—The preparation and color changes of indicators prepared from *Ascidia atra*, *Ptychodera* sp., *Chromodoris zebra*, and *Eupolymnia aurantiaca* (?) are reported.

The influence of fluorspar on the solubility of basic slag in citric acid, G. S. ROBERTSON (*Jour. Soc. Chem. Indus., 35 (1916), No. 4, pp. 216, 217*).—Experimental data submitted indicate that the citric-acid test gives no true

index of the phosphate present in fluorspar slags and affords no guide as to the value of the slag. The phosphatic slag obtained by the use of fluorspar in the manufacture of steel by the open-hearth process has a low citric-acid solubility. The phosphate is, however, completely soluble if the extraction be prolonged for a sufficient time. The phosphates in the slag do not appear to be in combination with silica, but seem to bear a close resemblance to those contained in mineral phosphates.

Improved methods for fat analysis, E. B. HOLLAND, J. C. REED, and J. P. BUCKLEY (*Massachusetts Sta. Bul. 166 (1915), pp. 91–138, figs. 4*).—This bulletin outlines the methods for determining the various chemical constants of oils, fats, and waxes. The methods have been carefully studied and many improvements both in the apparatus and technique introduced. Tabulated data and supplementary notes of value in the interpretation of analytical results, together with formulas for calculating certain other constants, are included.

A new procedure for the determination of the acetyl number is described as follows: Into a 300 cc. Erlenmeyer flask are brought 5 gm. of fat together with 10 cc. of acetic anhydrid. The flask is connected with a spiral or other form of reflux condenser and heated in a boiling water bath for from 1 to 1.5 hours. After acetylating, the condenser is removed from the flask and sufficient ceresine added to form a solid disk with the fat when chilled in cold water. With the flask still in the water bath 150 cc. of boiling water is added, with as little disturbance of the fat layer as possible. The flask is then removed and the contents rotated vigorously to dissolve occluded acetic acid. The ceresine fat is then solidified by immersing the flask in cold water, after which the solution is decanted through a dense filter, care being taken not to break the insoluble cake. Another 150 cc. of boiling water is added, thoroughly agitated, heated a few minutes in the bath, cooled, and decanted. The process is repeated until the final filtrate gives a decided color with two or three drops of tenth-normal alkali, using phenolphthalein as indicator. The filter and inverted flask containing the cake of ceresine fat are allowed to drain in a cool place until practically dry. The small particles adhering to the filter are then scraped into the flask, the inner portion of the filter paper extracted in a small beaker with three successive 20 cc. portions of boiling alcohol, and poured into the flask. Fifty cc. of alcoholic potash and several glass beads are then added, the flask is connected with a suitable form of reflux condenser, and the solution boiled on the water bath until saponification is complete. After cooling the solution to 60° C. it is titrated with half-normal hydrochloric acid, using 1 cc. of phenolphthalein or cotton blue, as indicator. The alcoholic mixture is again brought to boil to free any alkali occluded in the ceresine, and retitered if necessary. Several blank determinations should be run with every series of tests, under precisely similar conditions as to time and treatment except that the ceresine may be omitted. Every lot of ceresine, however, must be tested and be free from soluble matter and not assimilate any alkali on saponification. The difference between the titration of the blanks and that of the excess alkali in the test is the acid equivalent of the fat after acetylation, which is calculated to milligrams of potassium hydroxid per gram of fat.

For the determination of unsaponifiable matter the following modified procedure is described: Five gm. of fat are completely saponified in a 300 cc. Erlenmeyer flask with 75 cc. of alcoholic potash and 25 cc. of alcohol under a reflux condenser. The solution is then transferred to a 250 cc. Griffin beaker and the flask rinsed several times with hot alcohol. The alcohol is evaporated

in a water bath at a gradually increasing temperature. Several 25 cc. portions of methyl alcohol are added and evaporated to insure dryness. The dry residue is then pulverized in a mortar with 25 gm. of anhydrous potassium carbonate, dried 2 hours at 100°, transferred to an S. & S. extraction thimble, extracted from 2 to 3 hours with anhydrous ether in a continuous extractor, and the ether distilled off as usual. Any trace of moisture absorbed during the process will contaminate the ether extract with a small amount of water-soluble compounds. To eliminate this error the air-dried extract is washed with several 25 cc. portions of water at room temperature, decanted on an ether-extracted filter which is air-dried, and extracted with ether, using the same flask as before. The purified extract is dried from 1 to 1.5 hours in an oven at 100° and considered as unsaponifiable matter. This procedure is not applicable for volatile hydrocarbons or ethereal oils.

The use of enzyms and special yeasts in carbohydrate analysis, W. A. Davis (*Jour. Soc. Chem. Indus., 35 (1916), No. 4, pp. 201–210, fig. 1*).—Methods for the determination of saccharose, raffinose, maltose, and starch in plants and their products by means of enzyms are described in detail. On account of the specificity of the enzym action it is indicated that such methods are of especial value in estimating the individual constituents of a complex mixture of carbohydrates.

On the determination of reducing sugars in the presence of an excess of sucrose, L. Maquenne (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 6, pp. 207–213*).—The influence of large amounts of sucrose on the determination of reducing sugars has been studied in some detail and the results of the investigation reported.

The temperature at which the reduction takes place and also the time of heating exercises a marked influence on the results for the reducing sugars. Heating for 10 minutes at 65° C. is recommended as yielding the best results. The quantity of sample used in the analysis is also important. For materials poor in invert sugar 20 gm. samples are recommended.

The hyposulphite titration has been slightly modified and used with excellent results, especially for very small amounts of copper. The procedure, however, is not applicable in the analysis of molasses and similar materials which contain substances that absorb iodin. For such material the copper oxid must be determined either gravimetrically or by some other volumetric procedure.

An apparatus for digesting crude fiber, J. M. Pickel (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 366, 367, figs. 2*).—A simple form of condenser for use in crude fiber determinations which is easy to manipulate is described in detail. The form and construction of the condenser obviates the use of all rubber connections. It can be made of zinc, copper, or even glass. In the latter case an ordinary glass flask provided with a suitable side tube in its neck is quite satisfactory.

A furnace for crude fiber incineration, J. M. Pickel (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 367, fig. 1*).—An inexpensive and easily constructed furnace for use in crude fiber determinations is described in detail. It consists of a piece of asbestos board with a circular opening upon which is set a disk of wrought iron. An asbestos cylinder, specially prepared, is placed around the iron disk and is covered with a piece of asbestos board of the same dimensions as that of the base, having a small hole in its center. The heat is supplied by a small Bunsen burner.

The analysis of maple products.—VII, The electrical conductivity test for purity of maple sirup, J. F. Snell (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 331–333*).—Revised directions for the conductivity test of maple sirup previously noted (E. S. R., 31, p. 610) are submitted.

Genuine sirups have shown conductivity values as low as 96 and as high as 230. The limits of percentage variation of the conductivity value in genuine sirups are much narrower than those of any of the older analytical values, but not so narrow as those of the volumetric lead number. Additional analytical data on nonmaple sirups are reported.

A comparison of methods for the determination of casein in milk, C. B. HERSEY (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 335, 336*).—Although the official nitrogen method is the standard of accuracy for the determination of casein in milk, the analytical results obtained show that the Hart method (E. S. R., 19, p. 707) with electric centrifuge is dependable, checking very closely the official method. It is deemed far superior to the volumetric method of Van Slyke and Bosworth (E. S. R., 22, p. 112).

The Hart method possesses the advantages of requiring only a very little time and neither exactly standard solutions nor final calculation of results.

The occurrence and determination of creatin in the urine, F. H. MCCRUDDEN and C. S. SARGENT (*Jour. Biol. Chem., 24 (1916), No. 4, pp. 423–429*).—Experimental data submitted indicate that "human urine contains a substance or substances other than creatin which can give a color reaction similar to that of creatinin on boiling with picric acid, and which, therefore, may appear in the results as creatin."

The reduction of As_5 to As_3 by cuprous chlorid and the determination of arsenic by distillation as arsenic trichlorid, R. C. ROARK and C. C. MCDONNELL (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 327–331, fig. 1*).—Experimental data indicate that ferrous salts effect only an incomplete reduction of As_5 to As_3 in hydrochloric-acid solutions. Satisfactory results can be obtained only under certain conditions, usually with the presence of a small amount of copper which forms cuprous chlorid, or when only very small amounts of arsenic are present. Cuprous chlorid effectively reduces the arsenic in hydrochloric-acid solution and completely separates the arsenic trichlorid from antimony, lead, copper, zinc, iron, and calcium.

The method described consists of distilling a sample of the insecticide or fungicide in a hydrochloric-acid solution with cuprous chlorid and, after neutralization of the distillate, titrating the arsenic with standard iodin solution.

New methods for the analysis of lime-sulphur solutions.—II, The estimation of "polysulphur," R. M. CHAPIN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 339–341*).—In continuation of the work previously noted (E. S. R., 34, p. 806), the author has developed a new method for the estimation of polysulphur which is claimed to be both accurate and convenient.

The method, briefly outlined, consists of adding 10 cc. of a dilution of the sample to 10 cc. of a recently prepared 10 per cent solution of C. P. anhydrous sodium sulphite and 20 cc. of fifth-normal ammoniacal zinc chlorid contained in a 200 cc. Erlenmeyer flask. Twenty-five cc. of water is added and the mixture placed on the steam bath. At intervals of 10 minutes the contents of the flask are agitated and the material adhering to the sides of the flask rinsed down with a little hot water from a wash bottle. After heating for 45 minutes, with four intermediate mixings, the flask is removed from the water bath and 20 cc. of a 10 per cent solution of crystallized strontium chlorid added. The mixture is allowed to settle for 5 minutes and filtered into a 250 cc. volumetric flask and the precipitate washed with hot water. The clear liquid is then cooled to room temperature and from 0.5 to 1 cc. of a 10 per cent solution of crystallized disodium phosphate added, made to the mark, well shaken, and filtered through a dry paper into a dry flask, the first portions being used to thoroughly wet the paper, and the runnings discarded. To 200 cc. of this clear filtrate methyl red is added and then, slowly, with thorough mixing, a 10 per cent solution of

tartaric acid to a permanent slight acid reaction. Starch is now added, and the liquid titrated with tenth-normal iodin.

From the titration figures obtained from this procedure and those previously described the various forms of sulphur existing in the dilute lime-sulphur solution can be calculated by formulas which are submitted. Suggestions on the execution of the proposed method are discussed in detail.

It is concluded that "the use of a single standard solution which can be so easily and accurately prepared and used as tenth-normal iodin means a possibility of increased accuracy, as well as a saving of time, over the gravimetric estimation of sulphur as barium sulphate under conditions which demand the employment of an empirical factor."

Phenolic insecticides and fungicides, G. P. Gray (*California Sta. Bul. 269 (1916), pp. 327–381, figs. 9*).—This bulletin is divided into three parts.

Part 1 gives a general discussion of phenolic insecticides and fungicides and a classification, description, and data as to the properties of materials found on the market, both of refined phenols and compounded remedies. It is indicated that all the cresols are more active fungicides than phenol. Commercial cresol is usually a mixture of the three cresols. The term crude cresylic acid is deemed more appropriate to be applied to the material commonly sold as crude carbolic acid.

Part 2 gives the classification and tabulation of the results of analyses of samples taken during the fiscal years 1911–12 and 1912–13, and comments. Although many products were found to be below guaranty, manufacturers and dealers are not accused of willfully making or selling low-grade or nonstandard products. It appears, however, that material has often been guarantied and sold with but little knowledge of its composition.

Part 3 gives methods of examination and descriptions of apparatus, including a steam distillation battery, a mechanical shaker, and a small device for holding flasks in a water bath. Qualitative methods most frequently used are described and references to methods for the complete examination of the material used by the U. S. Department of Agriculture are included.

Progress in peanut milling, T. B. Reese (*Texas Sta. Circ. 12, n. ser. (1916), pp. 3–6*).—This circular describes in detail the methods commonly used in peanut milling. It is indicated that the cost of milling peanuts at the present time is greater than that of milling cotton seed. The cost of a ton of farmer's stock, which includes from 200 to 300 lbs. of waste, is about $55. The products from this material, viz, about 65 gal. of oil and about 1,200 lbs. of cake, will yield the miller about $64, or a margin of $9.

Some chemical changes in the resweating of seed-leaf tobacco, H. R. Kraybill (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 336–339*).—The investigation is summarized as follows:

"The greatest loss of dry matter during the resweating process occurs in the proteins, nicotin, ether extract, and nitrogen-free extract. The total nitrogen, ammonia, nitric acid, and crude fiber show slight losses. The amids and reducing substances show an increase. The changes during the resweat are quite similar to those of the first sweating process. It seems, therefore, that the resweat is a continuation of the first sweating process. . . .

"The total loss in nitrogen is 0.61 per cent. The difference between the total loss of nitrogen and the loss of nitrogen as nitric acid, ammonia, and amids (loss of protein nitrogen minus amid gain in nitrogen) is 0.28 per cent. It appears from this that most of the nicotin which is lost is lost by volatilization. This is in accord with the results of Garner [E. S. R., 20, p. 936].

"It is evident that a breaking down of proteins into amids occurs. From this we can readily see that there is probably an enzym present which is

capable of breaking down the proteins. Since the increase in amid nitrogen is not so great as the loss in protein nitrogen it suggests that there may be present a ferment which breaks up the amino acids, although no definite conclusions can be drawn."

METEOROLOGY—WATER.

Report of the meteorological station at Berkeley, California, for the year ending June 30, 1914, W. G. Reed (*Univ. Cal. Pubs., Georgr., 1 (1916), No. 9, pp. 373–439, pls. 12, figs. 9*).—The instrumental installation and the character and methods of observations made are briefly described, and observations on temperature, pressure, precipitation, atmospheric moisture, frost, and wind are reported. A summary of the results of a hydrographic survey (rainfall and run-off) of Strawberry Creek, near the university, is also included.

The mean annual temperature for the year was 58° F. The extreme range of temperature was about 70°. September was the warmest month and December the coldest. The maximum temperature, 105.5°, occurred September 16, 1913; the minimum, 36°, was recorded December 15, 1913, and January 9, 1914. Frost occurred from November to March. The relative humidity averaged 86 per cent morning and night, and the mean dew point was about 44° in winter and 54° in summer. Nearly 40 per cent of the days were generally clear. Fog was observed on 29 days. The total precipitation was 33.58 in. or 7.12 in. more than the average.

Meteorological observations, J. S. Stevens (*Maine Sta. Bul. 245 (1915), pp. 309–310*).—A monthly and annual summary of observations at the University of Maine on temperature, precipitation, cloudiness, and wind movement during 1915 is given. The mean temperature for the year was 46.21° F., as compared with an average of 42.73° for 47 years; the total precipitation was 38.87 in., as compared with mean annual precipitation of 42.67 in. for 47 years; the snowfall was 49.1 in., as compared with 87.34 in. as the average of 47 years; the number of clear days was 177; the number of cloudy days, 121; and the total movement of wind was 48,224 miles.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and D. Potter (*Massachusetts Sta. Met. Buls. 327, 328 (1916), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1916, are presented. The data are briefly discussed in general notes on the weather of each month.

Weather summaries, L. R. Waldron (*North Dakota Sta., Rpts. Dickinson Substa., 1911, pp. 13, 14; 1912, pp. 16, 17; 1913, pp. 37–39*).—Observations at Dickinson, N. Dak., during 1911, 1912, and 1913 on temperature and rainfall are summarized by months and compared with the normals. Data relating to early and late frosts are also given.

Climatic conditions of Minnesota, U. G. Purssell (*Univ. Minn., Geol. Survey Bul. 12 (1915), pp. 10–29, figs. 12*).—The geographic and physiographic features which affect the climate of the State are briefly described.

The climate is continental, modified to a considerable extent by numerous inland bodies of water. The State "is in the path of a large proportion of the low-pressure areas which move across the United States from west to east. These areas move at an average speed of 600 miles in 24 hours and are preceded by southerly winds and higher temperature and followed by northerly winds and lower temperature. They are usually accompanied by cloudy weather and precipitation, each storm causing an average of from one to two rainy days as it crosses the State. As there is an average of almost two of these storms each

tartaric acid to a permanent slight acid reaction. Starch is now added, and the liquid titrated with tenth-normal iodin.

From the titration figures obtained from this procedure and those previously described the various forms of sulphur existing in the dilute lime-sulphur solution can be calculated by formulas which are submitted. Suggestions on the execution of the proposed method are discussed in detail.

It is concluded that "the use of a single standard solution which can be so easily and accurately prepared and used as tenth-normal iodin means a possibility of increased accuracy, as well as a saving of time, over the gravimetric estimation of sulphur as barium sulphate under conditions which demand the employment of an empirical factor."

Phenolic insecticides and fungicides, G. P. GRAY (*California Sta. Bul. 269 (1916), pp. 327–381, figs. 9*).—This bulletin is divided into three parts.

Part 1 gives a general discussion of phenolic insecticides and fungicides and a classification, description, and data as to the properties of materials found on the market, both of refined phenols and compounded remedies. It is indicated that all the cresols are more active fungicides than phenol. Commercial cresol is usually a mixture of the three cresols. The term crude cresylic acid is deemed more appropriate to be applied to the material commonly sold as crude carbolic acid.

Part 2 gives the classification and tabulation of the results of analyses of samples taken during the fiscal years 1911–12 and 1912–13, and comments. Although many products were found to be below guaranty, manufacturers and dealers are not accused of willfully making or selling low-grade or nonstandard products. It appears, however, that material has often been guarantied and sold with but little knowledge of its composition.

Part 3 gives methods of examination and descriptions of apparatus, including a steam distillation battery, a mechanical shaker, and a small device for holding flasks in a water bath. Qualitative methods most frequently used are described and references to methods for the complete examination of the material used by the U. S. Department of Agriculture are included.

Progress in peanut milling, T. B. REESE (*Texas Sta. Circ. 12, n. ser. (1916), pp. 3–6*).—This circular describes in detail the methods commonly used in peanut milling. It is indicated that the cost of milling peanuts at the present time is greater than that of milling cotton seed. The cost of a ton of farmer's stock, which includes from 200 to 300 lbs. of waste, is about $55. The products from this material, viz, about 65 gal. of oil and about 1,200 lbs. of cake, will yield the miller about $64, or a margin of $9.

Some chemical changes in the resweating of seed-leaf tobacco, H. R. KRAYBILL (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 336–339*).—The investigation is summarized as follows:

"The greatest loss of dry matter during the resweating process occurs in the proteins, nicotin, ether extract, and nitrogen-free extract. The total nitrogen, ammonia, nitric acid, and crude fiber show slight losses. The amids and reducing substances show an increase. The changes during the resweat are quite similar to those of the first sweating process. It seems, therefore, that the resweat is a continuation of the first sweating process. . . .

"The total loss in nitrogen is 0.61 per cent. The difference between the total loss of nitrogen and the loss of nitrogen as nitric acid, ammonia, and amids (loss of protein nitrogen minus amid gain in nitrogen) is 0.28 per cent. It appears from this that most of the nicotin which is lost is lost by volatilization. This is in accord with the results of Garner [E. S. R., 20, p. 936].

"It is evident that a breaking down of proteins into amids occurs. From this we can readily see that there is probably an enzym present which is

capable of breaking down the proteins. Since the increase in amid nitrogen is not so great as the loss in protein nitrogen it suggests that there may be present a ferment which breaks up the amino acids, although no definite conclusions can be drawn."

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Effect of grinding on the lime requirement of soils, R. C. Cook (*Soil Sci., 1 (1916), No. 1, pp. 95–98*).—Experiments conducted at Rutgers College on six different soils are reported, the results of which are taken to indicate that "soils should not be ground if used for determination of lime requirement by the Veitch method. Grinding sandy soils of New Jersey increases their acidity instead of decreasing it, according to the method employed."

Albuminous bases formed from organic matter of soils by hydrolysis, A. Shmuk (*Zhur. Opytn. Agron., 16 (1915), No. 4, pp. 281–298; abs. in Chem. Abs., 10 (1916), No. 2, p. 243*).—By long enough boiling of soil or humic acid with 25 per cent sulphuric acid the author succeeded in isolating and identifying two compounds which he classed as amino acids. Arginin and lysin were found in compounds obtained from three different chernozem soils.

[Soil moisture studies] (*North Dakota Sta., Rpt. Dickinson Substa., 1913, pp. 31–36, figs. 4*).—Studies on four loam soil wheat plats (A) continuously cropped, spring plowed, (B) continuously cropped, fall plowed, and (C and D) alternately cropped and summer fallowed showed an increase in moisture in all the plats between October and April and a decrease during the remainder of the season. The spring-plowed plat showed considerably less moisture than the fall-plowed plat. Plats C and D showed about the same amounts of water available to the crop until the crop began to draw heavily on the available water, after which the plat recently fallowed lost but little water, while the upper 3 ft. of the other plat became as dry as plats continuously cropped. In the lower 3 ft. of the fall-plowed plat and Plats C and D there was an increase in the amount of growth water from the fall until the following spring. In the spring-plowed plat there was a decrease. The water available to crops was used most economically on the spring-plowed plats.

Similar data for barley plats are also reported, but are apparently deemed unsatisfactory.

Soil gases, J. W. Leather (*Mem. Dept. Agr. India, Chem. Ser., 4 (1915), No. 3, pp. 81–134, figs. 4*).—An apparatus for the abstraction of soil gases from undisturbed soil samples and a method of estimation of the argon content of the soil are described, and results of studies of Pusa and other Indian soils are reported. The object was to obtain more definite information regarding the gases present during the decomposition of green manure, the gases of swamp rice soil, the assimilation of nitrogen by Papilionaceæ, the gases present near the roots of crops, and changes during nitrification.

It was found that the volume of gas in soils determined by direct measurement is approximately equal to that determined by indirect calculation. The volume of condensed gas in Pusa soil was too small to be estimated accurately and is thought to be not greater than 4 per cent of the gas present. The volumes of gas were smaller in wet weather than when the soil was dry. "The volume of displaced gas is not necessarily equal to the additional water, and the experimental results also show that one volume of water does not necessarily displace one volume of gas. At the same time the two approach equality.

"The whole of the gas is not displaced from a soil; even during the wettest weather the proportionate volume of gas only falls to 15 or 20 per cent, or about one-half the volume which is present during long periods of hot, dry weather.

"The soil gas of land which has been freshly treated with farm manure or green manure naturally contains a high proportion of carbon dioxid and a low proportion of oxygen, but it is evident from the information gained by operating with closed vessels (containing abundance of air) that were it not

for the process of diffusion, the proportions would be very different from what they are."

High proportions of carbon dioxid and frequently low proportions of oxygen were found in the neighborhood of the roots of such crops as hemp, indigo, and maize, together with small but definite quantities of hydrogen. "Although high proportions of carbon dioxid are frequently present in the gas as extracted from the soil, calculation shows that considerably the greater part is present in the dissolved state in the soil solution."

Determination of the ratios of oxygen and nitrogen to argon in the soil gases showed "that the chief changes in the soil have to do with the oxygen, whilst nitrogen-assimilation or nitrogen-evolution in dry land is at least so limited that it is usually difficult to detect. . . . In cases like the gas from rice land, the argon determination demonstrates with certainty that most of the nitrogen is derived from the soil and manure. . . .

"It is certain that diffusion of gases through soils at a depth of from 12 to 15 in. is so efficient as to warrant the conclusion that cultivation of the surface soil is unnecessary for purposes of aeration. The well-established value of good cultivation must be referred to other causes."

Agronomic and soil conditions in the Selby smoke zone, C. F. Shaw and E. E. Free (*U. S. Dept. Int., Bur. Mines Bul. 98* (*1915*), *pp. 451–462*).—An investigation of the agronomic and soil conditions of the Selby smoke zone in Solano County, Cal., to determine the extent to which the vegetation is injured and the soil polluted by smelter fumes and dust in that district, is reported.

The opinion is expressed that while crop yields in the region are below what would be expected for such a climate, they may be attributed more to poor soil and poor agricultural practice than to some definite unfavorable factor such as smelter dust and fumes. With reference to soil pollution, it is concluded that "arsenic is certainly a normal, though extremely minute, constituent of the soils of the region, and lead is probably so. The past contamination of the soils by lead and arsenic from the smelter is possible but unproved and appears not to be susceptible of proof. The quantities of lead and arsenic added, if any, have been small and of the same order as the quantities of these elements normally present in the soils. The maximum amounts of lead and arsenic found are far too small to have any injurious effect on plants grown in the soils. Much larger amounts than those actually found would be without practical effect on the agriculture of the region."

Data regarding soil samples are included.

Mississippi: Its geology, geography, soils, and mineral resources, E. N. Lowe (*Miss. Geol. Survey Bul. 12* (*1915*), *pp. 335, pl. 1, figs. 28*).—This is a popular report covering the geology, geography, mineral resources, underground waters, and soils of the State of Mississippi. The section on soils has been taken mainly from a previous report (E. S. R., 26, p. 811).

Soil survey of Johnson County, Missouri, B. W. Tillman and C. E. Deardorff (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 33, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station and issued May 5, 1916, deals with the soils of an area of 531,840 acres in western Missouri, lying in the residual prairie section of the Great Plains region. The topography is rather more rolling than undulating and level. The county is well drained. The soils are classed as upland soils of residual origin, which cover about 85 per cent of the area, and lowland soils of alluvial origin. Sixteen soil types of 10 series are mapped, of which the

Summit, Boone, Osage, and Bates silt loams cover, respectively, 27.5, 26.9, 12.2, and 11.1 per cent of the area.

The soils of Antigua, H. A. Tempany (*West Indian Bul., 15 (1915), No. 2, pp. 69–102, pls. 8*).—This report deals primarily with the physical and chemical characteristics of the soils of an island area of 108 square miles, which topographically is divided into three principal regions: (1) A generally flat central plain, which traverses the island diagonally from west to east; (2) a northeastern limestone area consisting of undulating country; and (3) a mountainous southwestern area of volcanic origin.

The soils of the limestone area approximate very closely to a single physical type in which the particles of the fine silt and clay on the average constitute 65.9 per cent of the soil. "The soils of the low-lying central portion of the island . . . comprise a series of heavy clay soils deficient in calcium carbonate, requiring thorough tillage and drainage for the maintenance of tilth." The soils of the southern district are noncalcareous and well drained, and "approximate fairly closely to one physical type in which the larger and the smaller particles are nearly balanced."

Tables showing the mean physical composition of the principal soil types encountered on the island are appended.

Studies on soil protozoa, S. A. Waksman (*Soil Sci., 1 (1916), No. 2, pp. 135–152*).—Studies with loam soils of high and low humus content and clay soils on (1) the activity of protozoa in the soil, (2) the numbers and types of protozoa in different soils at different depths, and (3) the effect of protozoa on bacterial numbers and their decomposition of organic matter in the soil are reported.

It was found that moisture, humus content, and the structure of the soil were the important factors governing the activities of the protozoa. Sterilization of soil and the addition of easily soluble organic matter made the conditions optimum for protozoan activities at a lower moisture content than the corresponding unsterilized or untreated soils. The flagellates were the most common soil protozoa found active in the soil with moisture content too low for the development of the other groups.

"The flagellates are the largest group of soil protozoa; the greatest number of flagellates are found in the soil just below the surface; the ciliates at a depth of 4 in.; the numbers decrease with the depth, so that below 12 in. the soil is practically free from protozoa. Soil protozoa do not have any appreciable influence upon the ammonification by bacteria. The presence of protozoa acts detrimentally upon bacterial numbers, so that when the conditions become favorable for protozoa development, the bacterial numbers decrease."

The spirit of the soil, G. D. Knox (*London: Constable & Co., Ltd., 1915, pp. XIII+242, pls. 16*).—This book gives a popular account of nitrogen fixation in the soil by bacteria and of the production of auximones in bacterized peat according to Bottomley. It contains chapters on the nitrate problem; England's food supply in peace and war; bacteria and protozoa; peat and its uses; fixation of nitrogen by leguminous plants; humus; bacterized peat, its preparation and general properties; vitamins, accessory food bodies, and auximones; elementary conceptions of chemistry in relation to the soil; the testing of humogen; the preparation of humogen; and how humogen is applied. Two final sections give the results of experience along the above lines.

It is the main contention of this book "that soil inoculation scientifically carried out will greatly increase the yield of the land that is already under cultivation, and that it will bring into cultivation large tracts of land that it has hitherto not paid to cultivate, and that by the stimulation of plants it will

be possilbe to bring fruit and flowers to maturity earlier than can be done by other means."

Considerable space is devoted to the newly discovered accessory food bodies or auximones in bacterized peat. A number of different experiments are reported, the results of which are taken to indicate "conclusively that bacterized peat contains a substance or substances which stimulate the growth of the plant and enable it to utilize the normal food constituents supplied to it. In nature the need is doubtless supplied by the decaying organic matter in the soil."

Bacterial activities and crop production, P. E. Brown (*Iowa Sta. Research Bul. 25* (*1915*), *pp. 359–388*).—The substance of this bulletin has been previously noted from another source (E. S. R., 34, p. 619).

The reclamation of bog land (*Dept. Agr. and Tech. Instr. Ireland Jour., 16* (*1916*), *No. 2, pp. 229–236, pls. 10*).—A number of pot and field experiments conducted for three years with different common crops on Irish bogs are reported, the results of which are taken to indicate that lime is the limiting factor in the reclamation of Irish bogs while phosphate is next in importance.

"Notwithstanding the large amount of nitrogen in the peat, the necessity of supplying this ingredient in a form in which the plant can use it was clearly demonstrated. . . . As long as the different crops were producing leaf and stem only, potash was the least important of the four ingredients, but its influence was most marked in filling the grain and stiffening the straw in the case of the rye and of increasing the yield of tubers in the case of the potato."

An experiment with marls and shell sands as substitutes for lime on these soils showed that most of the marls and shells tested were as good as burned lime.

Analysis of plants and soils to determine the amounts of nutritive substances in soils, T. Pfeiffer, E. Blanck, W. Simmermacher, and W. Rathmann (*Landw. Vers. Stat., 86* (*1915*), *No. 5–6, pp. 339–391; abs. in Chem. Zentbl., 1915, II, No. 5, pp. 239, 240; Ztschr. Angew. Chem., 28* (*1915*), *No. 65, Referatenteil, p. 421; Jour. Chem. Soc.* [*London*], *108* (*1915*), *No. 634, I, pp. 763, 764; Jour. Soc. Chem. Indus., 34* (*1915*), *No. 18, p. 972*).—Pot and laboratory experiments with seven different soils to determine the usefulness of plant and soil analysis in estimating the fertilizer needs of soils are reported, being based in part on the results of previous work (E. S. R., 29, p. 514).

The conclusion is drawn that in establishing uniformity in the available water content of different soils, the content of hygroscopic water represents the water content at which plant growth starts only in so far as with increasing hygroscopicity of the soils a corresponding water addition is necessary. On this basis, crop substances were obtained on different soils which showed only a slight variation in the content of the nutritive constituent present in minimum, or the so-called normal content. This is taken to indicate that the physical properties of soil are not of great importance in plant production in so far as they do not influence the factor water. It is concluded further that the so-called normal content of any nutritive constituent does not offer a sufficient comparative basis on which to interpret plant analysis in terms of fertilizer needs of the soil.

It was further found that the amount of nitrogen taken up by plants from an unmanured soil was only slightly increased by manuring with an excess of phosphoric acid and potassium. Assimilation of phosphoric acid, on the other hand, was much more influenced by application of nitrogen and potassium, partly owing to greater root development and partly to increased solubility of the soil phosphates, which varied with different soils. The same held good in the case of potassium.

Oat plants assimilated only about 10 per cent of the phosphoric acid dissolved by 1 per cent hydrochloric acid, while with potassium the results agreed much more closely. Water saturated with carbon dioxid dissolved much less phosphoric acid than was asssimilated by oats in the same soil. In this case the difference is attributed to the presence of organic acids in the roots, to the dissolving action of manurial salts, and to disturbances in the equilibrium of the soil solution. It is thought that the potassium fixed by absorption in soils, as estimated by Kellner, can not be the only source of potassium available to plants. While it was found that neither analysis of plants nor soil analysis, as employed, is suitable for establishing the amounts of nutrients in soils, it is considered likely that useful indications will be obtained by ascertaining the maximum amounts of nutritive substance which give increased yields.

Carbon and nitrogen changes in the soil variously treated: Soil treated with lime, ammonium sulphate, and sodium nitrate, R. S. Potter and R. S. Snyder (*Soil Sci., 1 (1916), No. 1, pp. 76–94, pl. 1, figs. 2*).—The work of others bearing on the subject is briefly reviewed, and pot experiments conducted at the Iowa Experiment Station to determine the influence of additions per acre of 3 tons of calcium carbonate, 1,285 lbs. of sodium nitrate, 1,000 lbs. of ammonium sulphate, and of combinations of calcium carbonate with each of the nitrogen fertilizers in the amounts noted, on nitrogen losses, carbon dioxid evolution, and on changes in the ammonia, nitrate, nitrogen, and carbonate contents of an acid silt loam soil low in organic matter, are reported.

It was found that "for all the soils except those treated with both ammonium sulphate and lime, about 0.3 lb. of ammonia nitrogen was given off in 12 weeks. If kept up throughout the year, this would mean a loss of a little over a pound per acre in a year, an insignificant amount when compared to that lost by leaching, cropping, etc. The loss from the soils treated with both lime and ammonium sulphate was about ten times as high for the period of the experiment, but it is not at all probable that this rate would be held for a very long period after the application of the sulphate. Therefore, . . . the danger of loss of ammoniacal nitrogen from the soil of the type used is practically negligible. In a general way, the total nitrogen determinations show there is a smaller loss or a greater gain of nitrogen for the limed soils than the corresponding unlimed soils."

The results with reference to the amounts of carbon dioxid evolution were inconclusive and the experiment is being continued.

A list of 22 references to literature bearing on the subject is given.

The influence of some common humus-forming materials of narrow and of wide nitrogen-carbon ratio on bacterial activities, P. E. Brown and F. E. Allison (*Soil Sci., 1 (1916), No. 1, pp. 49–75*).—Experiments, conducted at the Iowa Experiment Station, with a slightly acid sandy loam soil low in organic matter content to determine the influence of applications per acre of 15 tons of each of horse, cow, and rotted manure; 2.5 tons of oat straw; 3 tons of corn stover; 2 tons of timothy hay; and 4 tons of each of cowpea and clover hay, on ammonification, nitrification, and nitrogen fixation, are reported.

It was found that "application of the common humus-forming materials in maximum amounts for farm conditions and in a dried condition increased bacterial activities, ammonification, nitrification, and azofication to a considerable extent. Horse manure, cow manure, and rotted manure gave the greatest effect on ammonification in most cases, although timothy hay surpassed the horse manure and cow manure in the extent of its effect in several instances. The oat straw and corn stover had a lesser effect than the manures, and the legume hays, clover, and cowpeas showed the least effect on ammonification of any of the materials used.

"Increases in ammonification due to the applications of humus-forming materials were independent of the nitrogen-carbon ratio of the materials added. . . . The dried-blood-fresh-soil method gave better results for ammonification than the casein-fresh-soil method. The latter gave better duplicate results, but the differences between different soils were not nearly so pronounced. . . .

"Nitrification was increased in much the same way as ammonification by the various organic materials. The leguminous green manures exerted, however, somewhat greater effects than the manures, and also more influence than the nonlegumes. These results were the opposite of those secured with ammonification, but the differences were not great enough to permit of definite conclusions. Increases in nitrification brought about by the various materials were apparently independent of the nitrogen-carbon ratio in the substances. Indications of a greater effect of materials of a narrower ratio over those of a wide ratio can not be considered conclusive.

"Azofication or nonsymbiotic nitrogen fixation was favored by manure to a large extent. Straw, stover, and nonleguminous hays had almost as great an effect as to the manures, and the leguminous hays had the least effect of any of the materials used. The nitrogen-carbon ratios of the materials employed were of little or no significance in indicating their effects on azofication. There were indications, however, that nonlegumes and straws might increase azofication in soils to a large enough extent to make their use more profitable than that of legumes. . . . Dextrose gave better results in the azofication experiments than mannite. . . .

"There was little similarity between the effects of the different organic materials on the different bacterial processes. . . . The manures and legumes increased the first crop of oats, except in the case of the horse manure, which apparently exerted an injurious effect on the crop in its early stages of growth. . . .

"The substances with wide nitrogen-carbon ratio decreased the crop yield, while those of narrow ratios gave increases. The nitrogen factor was evidently very important on this soil. The nitrogen-carbon ratio of the organic materials seemed to be of importance in determining the influence on the first crop of oats. If opportunity is to be given for nonlegumes to exert as good an effect as legumes, by increasing azofication to a sufficient extent to offset the nitrogen supplied by the legumes, the organic materials must be allowed sufficient time for considerable decomposition to occur before a crop is grown. . . . The influence of the various substances applied to the soils was noted on a second crop of oats, but the relative effects were different. The nonlegumes had as great an influence as the legumes. . . . The nitrogen-carbon ratio of the materials applied to the soil did not seem to be of as much importance in determining the effect on the second crop of oats as in the case of the first crop."

Four references to literature bearing on the subject are cited.

Contribution to the question of the action of stimulants on plant development, B. Schulze (*Landw. Vers. Stat., 87 (1915), No. 1, pp. 1–24, fig. 1; abs. in Jour. Chem. Soc.* [*London*], *108 (1915), No. 636, I, p. 926; Jour. Soc. Chem. Indus., 34 (1915), No. 22, p. 1157; Chem. Zentbl., 1915, II, No. 11, p. 622*).—Pot experiments on a clay soil mixed with compost to determine the stimulating influence of the hydroxid, carbonate, nitrate, phosphate, and sulphate of manganese and of aluminum sulphate, singly and in different combinations, on the growth of sugar beets, when added in amounts equivalent to from 1.2 to 12.2 gm. of manganese per 20 kg. of soil, are reported.

It was found that all the manganese salts used produced an increase in the beet root yield. The most favorable influence was exerted by the manganese phosphate in all amounts added and by the combination of manganese sulphate with aluminum sulphate. The small additions of manganese nitrate produced the greatest increases. All increases in yield are attributed only to the stimulating influence of the manganese.

A second set of pot experiments on a productive cultivated soil to determine the influence of a radio-active fertilizer on the growth of oats, white mustard, and peas when added in amounts of 0.4, 0.8, 1.6, and 4 gm. per 21 kg. of soil in zinc pots, and in amounts of 0.23, 0.46, 0.92, and 2.3 gm. per 13 kg. of soil in clay pots, is reported. It was found that the radio-active fertilizer was especially active in stimulating fruit formation and that this influence was exerted without an undue exhaustion of the nutritive constituents in the soil. No injury to the crops through the larger additions of the radio-active fertilizer was observed.

The influence of certain organic materials upon the transformation of soil nitrogen, R. C. WRIGHT (*Jour. Amer. Soc. Agron., 7 (1915), No. 5, pp. 193–208, figs. 7*).—Experiments on the influence of dried, fresh, and rotted stable manure, mature wheat straw, starch, cellulose, glucose, dextrose, and green manures on nitrogen in the forms of ammonium sulphate, potassium nitrate, and peptone and on the original nitrogen in sandy and clay loam soils, greenhouse bench soil, orange grove soil, and silty loam soil are reported.

From the results the conclusion is drawn "that in agricultural practice the plowing under, in an undecayed state, of straw or strawy material such as old hay, litter, leaves, stalks, strawy manure, fresh stable manure, and even green manures or cover crops that have been allowed to become mature or nearly so, will serve to reduce the quantity of available nitrogen in a soil. When such a practice is followed only during fall plowing and in a region with a fairly open winter . . . a sufficiently advanced stage of decomposition would be reached by spring not to interfere with normal nitrification. . . . Plowing under of green manures presents a different problem because very little resistant cellulose material is added. Such succulent green material is readily attacked by saprophytic micro-organisms and rather rapid decay accompanied by vigorous nitrification takes place, thus maintaining the supply of available nitrogen."

The fixation of nitrogen in stable manure, GERLACH (*Ztschr. Ver. Deut. Zuckerindus., No. 717 (1915), II, pp. 547–554, fig. 1*).—The results of several experiments are briefly reported which indicate that the addition of superphosphate, certain potash salts such as kieserit, or acid salt by-products from chemical industries to liquid manure in amounts sufficient to produce an acid reaction will cause a marked reduction in nitrogen losses. A film of oil over the top of liquid manure had the same effect. Everything considered, however, the best results were obtained from the use of superphosphate.

Fertilizer experiments with different ammonium salts in Weihenstephan in 1915, AHR (*Mitt. Deut. Landw. Gesell., 30 (1915), No. 46, pp. 696–699*).—Field experiments with early potatoes and with rotations of wheat, oats, and potatoes and potatoes, wheat, and beets on marly loam and deep mild loam soils to compare the fertilizing value of ammonium chlorid, ammonium carbonate, ammonium-sodium sulphate, ammonium nitrate, ammonium sulphate, sodium nitrate, calcium nitrate, and lime nitrogen with nitrogen contents of 23.1, 16.76, 7.65, 34.2, 19.9, 16.01, 12.64, and 19 per cent, respectively, are reported. The fertilizers were added in amounts equivalent to 30, 45, and 60 kg. per hectare (26.7, 40, and 53.4 lbs. per acre) of nitrogen.

It was found that the ammonium salts, the ammonium-sodium sulphate and ammonium chlorid gave results equal to those given by ammonium sulphate. Ammonium carbonate was too unstable to be effectively handled. Lime nitrogen when properly used gave results very little inferior to those given by the other fertilizers. Ammonium nitrate was found to be an effective and easily handled fertilizer. All the fertilizers gave increases in spite of the already rather high producing power of the soil for beets, calcium nitrate being in general more effective for this crop than sodium nitrate or ammonium nitrate.

Fixation of atmospheric nitrogen, L. L. SUMMERS (*Trans. Amer. Electrochem. Soc., 27 (1915), pp. 339–383, figs. 5*).—This article reviews the known processes of commercial nitrogen fixation, points out that the electrical processes for nitrogen fixation have a very low efficiency, and maintains that combinations of electrical and chemical methods promise the most important developments. Comparative figures are given showing the amount of energy necessary per kilogram of nitrogen fixed, and the general economics of the subject are discussed.

The cyanamid process, F. S. WASHBURN (*Trans. Amer. Electrochem. Soc., 27 (1915), pp. 385–407*).—The details and economics of this and related processes are discussed.

The utilization of bones as fertilizer, F. LAVENIR (*Bol. Min. Agr.* [*Buenos Aires*], *19 (1915), No. 8–9, pp. 569–576*).—The results of analyses of fresh, degreased, and burned bones are reported and discussed, and methods of treatment described. It is considered evident that for certain plants (especially alfalfa) the treatment of bones by heat or with sulphuric acid to form superphosphate is not justified.

A reconnoissance for phosphate in the Salt River Range, Wyoming, G. R. MANSFIELD (*U. S. Geol. Survey Bul. 620–O (1916), pp. 331–349, pl. 1*).—This report describes the geography and geology of the locality and reports a study of the phosphate deposits.

"The data thus far available indicate that the phosphate deposits of the Salt River Range are probably inferior to those of southeastern Idaho both in thickness and in quality. There is, however, a considerable body of medium-grade rock which may be considered as a valuable reserve deposit. If the plan of grinding and applying phosphate rock directly to the soil without chemical treatment is found to produce beneficial results, some local demand for this rock might be developed."

The effect of superphosphate on the wheat yield in New South Wales, W. L. WATERHOUSE (*Dept. Agr. N. S. Wales, Sci. Bul. 10 (1913), pp. 10*).—An examination of the soils of the northern, western, and southern sections of New South Wales led to the conclusion that there is a relation between the responsiveness of these soils to the application of superphosphate in the production of wheat and the phosphoric acid content of the soils. This relation is more marked for the available phosphoric acid than for the total phosphoric acid content.

Evaporation of brine from Searles Lake, California, W. B. HICKS (*U. S. Geol. Survey, Prof. Paper 98–A (1916), pp. 1–8, figs. 2*).—In continuation of experiments previously noted (E. S. R., 34, p. 425) samples of natural brine from Searles Lake, Cal. (E. S. R., 33, p. 518), were subjected to fractional evaporation and crystallization. "The data recorded indicates that carefully controlled fractional evaporation and crystallization, possibly combined with other treatment, promise much as a means of obtaining potassium from brines similar to that of Searles Lake."

Twenty questions on lime, F. E. Bear (*West Virginia Col. Agr. Ext. Dept. Circ. 47 (1915), pp. 16, figs. 7*).—This is a brief popular summary of results obtained at different state experiment stations on the purchase, preparation, and use of different forms of lime in agriculture.

Sulphur in relation to soils and crops, J. W. Ames and G. E. Boltz (*Ohio Sta. Bul. 292 (1916), pp. 221–256*).—This bulletin deals with the sulphur supply of soils, reporting analyses of typical Ohio soils, and reports field experiments at the different experimental farms of the Ohio Station to determine the importance of sulphur as a factor in crop production.

It was found that "soils well supplied with organic matter contain more sulphur than soils containing a smaller amount of organic residues. Sulphur is similar to phosphorus in that larger amounts of both these elements are distributed in the surface soil than in the lower strata.

"Treatment with fertilizer materials supplying sulphates increased the sulphur content of the soil over that found in unfertilized soil. Soil treated with acid phosphate and ammonium sulphate contained more sulphur than soil receiving acid phosphate alone. Cultivation of silt loam soil for 16 years without the addition of fertilizers decreased the total sulphur supply.

"Water extract of soils obtained by leaching 200 gm. of soil with 2,000 cc. of water shows that there is a considerable accumulation of sulphates in silt loam soil deficient in organic matter. Treatment with acid phosphate has not increased the sulphate content over that found in unfertilized soil. Ammonium sulphate used in combination with acid phosphate decidedly increased the accumulation of sulphates. . . . A much less proportion of the total sulphur is found in the water extract of soils containing more organic matter and total sulphur. The amount of soluble sulphur obtained in the water extract of soils indicates a sufficient supply of available sulphur, assuming that sulphur as sulphates is a satisfactory form of this element.

"The 20-year average yields of the Wooster 5-year rotation fertility experiments show that phosphorus carriers (acid phosphate and dissolved bone black) containing sulphates, compared with bone meal and basic slag, produced more corn, oats, and wheat. Bone meal and basic slag increased the yields of clover and timothy. . . .

"Acid phosphate, compared with bone meal and basic slag in a 3-year rotation of potatoes, wheat, and clover has given larger yields of potatoes and wheat. In the 5-year rotation experiment conducted for 19 years on Strongsville clay, containing more sulphur than the Wooster silt loam, acid phosphate, compared with bone meal and basic slag, has given larger yields of corn, oats, and timothy. The yields obtained show that bone meal and basic slag are more effective than the dissolved boneblack used on this soil. The 3-year rotation fertility plats on Miami clay loam, which have had sulphur supplied by both acid phosphate and potassium sulphate, have produced less tobacco, wheat, and clover than plats to which muriate of potash and acid phosphate were added. . . .

"Under certain conditions of treatment, sulphates have increased the yield of soy-bean hay and the sulphur content of the crop. The addition of calcium sulphate to fertilizer treatment furnishing nitrogen, phosphorus, and potassium decreased the sulphur content of soy beans. Potassium sulphate and ammonium sulphate, compared with potassium chlorid and sodium nitrate, gave an increased yield of beans having a lower percentage of sulphur. Sulphates used with complete fertilizer and calcium carbonate decreased the yields of millet hay and millet seed. Sulphates considerably increased the accumulation of sulphur in millet hay and in soy-bean hay and decreased the content in the seed. No inorganic sulphur was found in soy beans and millet seed. Calcium sulphate in

addition to complete fertilizer increased the yield of rape. The proteid nitrogen and organic sulphur content of rape grown on soil treated with sulphates in addition to dicalcium phosphate, potassium chlorid, and sodium nitrate has been increased. The increased amount of sulphur assimilated by the rape crop, from soil treated with sulphur in addition to phosphorus, potassium, and nitrogen, is mostly combined as organic sulphur. The nonproteid nitrogen found in the rape plant grown under the conditions of this experiment is in excess of the proteid nitrogen.

"On limed soil calcium and magnesium sulphate, in addition to phosphorus, potassium, and nitrogen, increased the yield over that from similarly treated plats receiving no sulphates. Potassium and ammonium sulphate on limed soil also produced more rape than plats where potassium chlorid and sodium nitrate furnished the potassium and nitrogen. Magnesium sulphate, where used with complete fertilizer and calcium carbonate, produced more soy beans and millet seed than calcium sulphate.

"The use of sulphur and hydrogen sulphid in pot tests increased the acidity of the soil. Pots so treated gave a greater weight of clover than the untreated or limed pots.

"Experimental data obtained by extracting mixtures of soil, sulphur, and rock phosphate with 0.2 per cent hydrochloric acid indicate that oxidation of sulphur has increased the solubility of the insoluble phosphorus."

A list of 25 references to literature bearing on the subject is appended.

The fertilizing power and harmfulness of fertilizing materials, A. VIVIEN (*Bul. Assoc. Chim. Sucr. et Distill., 32 (1914), No. 1–2, pp. 36–42; abs. in Chem. Abs., 9 (1915), No. 21, p. 2962*).—The author reviews work by himself and others showing the toxic effect of different salts on plants, and gives the toxic dose of each of 16 sodium, potassium, ammonium, and calcium salts for Bordeaux wheat. It is pointed out that sugar beets may be grown on soils containing amounts of salts which would be toxic to other crops, as the beets absorb the salts and gradually remove the excess of mineral matter from the soil. Such beets are said, however, to yield a sugar solution of low purity.

Fertilizer registrations for 1916, C. S. CATHCART (*New Jersey Stas. Bul. 290 (1916), pp. 3–32*).—This bulletin contains a list of 1,137 brands of fertilizers and their guaranties, as registered in New Jersey for the year ending October 31, 1916.

AGRICULTURAL BOTANY.

An experimental study of the rest period in plants: Physiological changes accompanying breaking of the rest period, W. L. HOWARD (*Missouri Sta. Research Bul. 21, pp. 3–72, figs. 10*).—In continuation of the author's study on the rest period of plants (E. S. R., 33, p. 520), a description is given of physiological investigations conducted to secure information on the specific effects produced by anesthetics and other agents employed in breaking the rest period of woody plants.

As a result of respiration and other studies, the conclusion is believed justified that the specific effect of all rest period breaking agents on dormant woody tissue is the stimulation of the enzyms. The rest period is believed to begin with the inhibition of enzyms by the accumulation of the products of their work. This may take place in mid or late summer. In the fall an excess supply of carbohydrates continues to be accumulated with the further inhibition of enzyms. This brings about the main or middle state of rest. Toward the end of this period enzyms become more and more active, giving place to the beginning of growth. The length of the rest period is said to vary greatly

with the different species, in some extending from June or July to March or April, while with others growth may begin again after two or three weeks of dormancy.

An extensive bibliography is appended.

The bearing of certain senile changes in plants on present theories of senility, H. M. BENEDICT (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 286*).—In a previous publication (E. S. R., 34, p. 222), the author described senile degeneration in *Vitis vulpina*, and in the present paper he gives an account of various theories regarding this phenomenon. He favors that advanced by Kassowitz, that senility is due to an accumulation of inert catabolic products, and he suggests that a more fundamental cause of senility may be found in the colloidal constitution of protoplasm with its units in the form of molecular complexes.

The favorable influence of nitrogen salts on seeds sensitive to light, G. GASSNER (*Jahrb. Wiss. Bot. [Pringsheim], 55 (1915), No. 2, pp. 259–342; abs. in Ztschr. Bot., 7 (1915), No. 9, p. 580*).—Giving the detailed results of extensive experimentation, the author states that the germination of seeds of *Ranunculus sceleratus*, *Œnothera biennis*, and *Chloris ciliata* is favorably influenced by light. This effect in case of the first named required variations of temperature, and these variations themselves favored germination. In case of *Œ. biennis*, light favored germination at both constant and varying temperatures. Seeds of *C. ciliata*, when freed from chaff, were not so influenced by temperature variations, and light acted favorably in this respect only at temperatures of about 20° C. and upward. It is stated that germination is favored not by nutritive media as such, but by salts containing nitrogen as nitrites, nitrates, and ammoniates, the effects of which in this respect are perceptible through a very wide range of concentrations.

The author also discusses recent related experimentation as reported by Ottenwälder (E. S. R., 33, p. 826).

New instances of the promotion of germination, by nitrogen compounds, of seeds sensitive to light, G. GASSNER (*Ber. Deut. Bot. Gesell., 33 (1915), No. 4, pp. 217–232*).—Discussing the tabulated results of tests with plants in widely separated families, the author emphasizes the fact that in these cases nitrogen variously combined in the nutritive media was found to show the same favorable action as did light. Some doubtful or contradictory results are reported.

Studies on light and temperature as related to the germination of seeds, G. GASSNER (*Ber. Deut. Bot. Gesell., 33 (1915), No. 4, pp. 203–217*).—Giving the results of studies by other investigators the author reports a continuation of his own work (see above), using seeds of nine species of Onagraceæ, one of Hydrophyllaceæ, and two of Scrophulariaceæ.

It is stated that in the first group three different germination types may be distinguished as regards their relation to light and temperature. The second division is characterized by a low germinability optimum and by the injurious action of high germination temperatures, the favoring action of temperature change, and the unfavorable action of light at extreme germinating temperatures. In the third group, the seeds require stronger light at low temperatures. Temperature variations here also favor germination, especially when regular, giving the most marked results when the lower daily temperatures were maintained for longer periods than were the higher temperatures.

Influence of temperature on the moisture intake of seeds, C. A. SHULL (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 329*).—According to the author, a critical analysis of the data obtained as to the rate of moisture intake at various temperatures by seeds possessing semipermeable coats, shows that the

curve of intake is by no means so simple as that reported for barley by Brown and Worley (E. S. R., 28, p. 226). The temperature coefficient for the rate of intake is said to be decidedly lower than the Van't Hoff coefficient for chemical processes and considerably lower in the case of Xanthium than the values obtained with barley seeds. It is considered that the conclusions reached by Brown and Worley are not generally applicable.

Seed sterility and delayed germination in Œnothera, B. M. DAVIS (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 291*).—From a study of 50 or more species, races, and hybrids of Œnothera, the author reports considerable seed sterility and delayed germination. A method is suggested for rapidly forcing germination and for preserving for examination the residue of sterile seedlike structures.

The influence of the medium upon the orientation of primary roots, R. M. HOLMAN (*Abs. in Science, n. ser., 43, (1916), No. 1105, pp. 328, 329*).—By the use of media whose resistance to penetration by the root tip could be widely varied, the author was able to cause roots to behave very nearly as in the air or in the same manner as in the earth, according as the medium was loose or considerably compressed. These experiments are believed to indicate that the effect of the medium is primarily, if not exclusively, mechanical. Secondary roots of the species investigated behaved in a manner similar to the primary roots, reacting more promptly in media offering considerable resistance to penetration than in looser media.

The root growth of forest trees, W. B. MCDOUGALL (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 324*).—Observations made on the roots of *Acer saccharinum*, *Tilia americana*, *Carya alba*, and *Quercus macrocarpa* are reported for the growing season and during the winter from April, 1914, to September, 1915.

It was found that the root growth of forest trees begins as early in spring as the soil is warm enough for absorption and ceases in autumn when the soil becomes too cold. No summer resting period was found necessary. Where a summer resting period was observed, it was found to be due to a lowering of the water supply and not to any inherent tendency to periodicity.

The influence of electrical conditions in plants on the absorption by their roots of nutritive substances, D. SHUSHAK (CHOUCHAK), (*Zhur. Opytn. Agron., 16 (1915), No. 4, pp. 249–269, figs. 5*).—In continuation of previous work (E. S. R., 32, p. 328), the author states that experimental tests as tabulated show that up to a certain point the direction and intensity of the electric current passed through a plant condition the absorption of cations and of anions and determine the rate thereof. These variations in the absorption rate are apparently independent of electrolysis, as they do not follow Faraday's law. Dead and living wheat plants give results of the same character.

These facts suggest that some substances, probably colloidal, may be differently polarized under the influence of charges of different sign and intensity up to certain limiting values. Such charges are said to be directly observable in the absence of a current by the use of a delicate electrometer and to be modifiable by the addition of salts. The variations in rapidity of absorption of cations and in intensity of current show a degree of correspondence. It is thought that the electrical conditions in the roots of plants may be of significance in plant nutrition.

The structure of the bordered pits of conifers and its bearing upon the tension hypothesis of the ascent of sap in plants, I. W. BAILEY (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 329*).—Attention is called to the tension hypothesis of the ascent of sap in plants, which, as interpreted by Dixon, postulates continuous columns of water that are entirely free from bubbles of air or gas. The pit membranes of conifers are said to be not entire septa, and not to

be entirely impervious to undissolved gases and solids. Consequently the surface tension of the sap in the sieve-like pit membranes is not sufficiently great to prevent the penetration of air or gas under the tensile strains that are supposed to occur in tall trees.

Anatomical and physiological studies on the aquiferous vessels in plants, II, L. MONTEMARTINI (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 12 (1915), pp. 363–533, pls. 10*).—Claiming to have found that the number of conducting vessels in various plants increases from below upward, especially in the neighborhood of branches, and showing also in some cases a certain relation with the development of surface in the related transpiring organs, the author gives a detailed account of his recent studies on the number and size of the aquiferous vessels and the modifications of the woody elements in relation therewith.

He sums up much of the extensive data obtained from this work by stating that the quantitative and qualitative modifications which can be noted in the wood at various heights in an organ or system of organs, and which are variously combined according to species, individual, or environment, tend on the whole to increase toward the active wood, and more particularly that part which is in more intimate relation with the vascular elements, when measured by the number of the cells which are in direct contact with such elements. Both structure and content in these regions indicate very active changes between the vessels and the cells which surround them. This becomes more and more evident as parts are examined in regions showing greater activity of the transpiration stream.

A bibliography is appended.

On the permeability of certain nonliving plant membranes to water, F. E. DENNY (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 329*).—A report is given of a series of experiments with plant membranes in which quantitative measurements were made of their permeability to water. The membranes used were those of the seed coats of peanut, cycad, almond, English walnut, pumpkin, bulb-scale of onion, etc. Results are reported showing the temperature coefficient for a rise of 10° C., and also showing the permeability of the membranes as affected by the concentration of the bathing medium, direction of flow through the membrane, and as influenced by certain chemical constituents of the membrane.

Studies in permeability.—II, The effect of temperature on the permeability of plant cells to the hydrogen ion, W. STILES and I. JÖRGENSEN (*Ann. Bot. [London], 29 (1915), No. 116, pp. 611–618, figs. 4*).—Reporting a continuation of investigations previously noted (E. S. R., 34, p. 731) by methods which are further detailed, the authors claim to have shown that the rate of absorption of the hydrogen ion of hydrochloric acid in dilute solution by potato cells shows a simple exponential relation between time and the concentration of the acid, the absorption rate of potato cells being increased about 2.2 times for each 10° C. rise between 0 and 30°.

The production, by use of paraffin, of hypertrophic and hyperplastic growths in shoots, E. SCHILLING (*Jahrb. Wiss. Bot. [Pringsheim], 55 (1915), No. 2, pp. 177–258, figs. 43*).—Giving an account of the anatomical and physiological effects of artificially closing the stomata, the author states that the resulting changes observable in the shoot axis are due not to any chemical influence of paraffin or vaseline but to the limitation imposed by them upon the transpiration process, and perhaps also to the corresponding limitation of oxygen access. It is stated that in the overgrown cells the osmotic pressures are various but generally higher than in the normal cells. It is claimed also that by covering the surface of the twigs with paraffin, abnormal leaves and adventitious roots may be produced.

Some factors determining the presence of fat as a food reserve in woody plants, E. W. SINNOTT (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 328*).—Reserve fat is said to occur most abundantly in those woods in which the rays and parenchyma cells are comparatively thin-walled and well provided with pits, and to be particularly well developed in the cells immediately adjacent to the vessels. The fat is said to be practically absent in species with thick-walled, slightly pitted parenchymatous tissue.

These facts are claimed to suggest that the occurrence of fat in wood and its distribution may depend on the easy diffusion of some fat-forming ferment. Experiments show the presence of a fat-splitting ferment in the leaves and bark, which varies greatly in amount according to species and season but which is in general most abundant in the spring in those species in which reserve fat is most abundant in winter. It is suggested that this fat-splitting ferment may be reversible in its action, and during late summer and fall it may be diffused downward through the wood and bast, converting into fat the food reserve to which it has access.

On the properties of a chromogen generally present in plants, J. WOLFF and NADIA ROUCHELMANN (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 13, pp. 399–401*).—The authors, having extended their study as previously reported (E. S. R., 34, p. 32) to a number of plant families, state that the chromogens exhibit, besides their great sensitiveness to the action of laccase and hydriodic acid, a large number of characters in common, some of which are here enumerated, indicating that they should probably be regarded as one and the same. The brown coloring matters that form in various plants or organs may be regarded as products of oxidation, as observable in case of the brown pigment of cut or injured potatoes, horse chestnut, dead leaves, and macerated green plants when subjected to the action of a laccase.

Lipolytic action in germinating teliospores of Gymnosporangium juniperi-virginianæ, G. H. COONS (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 327*).—A study was made of the teliospores from mature telial horns of *G. juniperi-virginianæ*, which seemed to indicate that in the germinating spores lipase is present. This places the rust fungi in the list of organisms now known to possess lipase. Attention is called to the occurrence of oil in rust spores, and the conversion of the globules of oil into soluble products, brought about by the lipase, is considered a factor in the rapid germination process.

Acidity and gas interchange in cacti, H. M. RICHARDS (*Carnegie Inst. Washington Pub. 209 (1915), pp. 107, figs. 6*).—The author gives an account of the methods and results of his work as carried out with cacti at the Desert Botanical Laboratory at Tucson, Ariz., along three main lines, namely, the determination of the acidity of the tissue as regards the expressed juice and the total amount of acid present, the determinations of carbon dioxid evolution to fix the diurnal periodicity in relation to normal temperature changes and to ascertain the effects of various agencies upon the rate, and the study of the gas interchange in darkness between plants and the atmosphere. The results are given in considerable detail and discussed in their bearings.

It is stated that with rising acidity in the tissues, the total acid increases more rapidly than does the concentration of the juice. Light, the most important factor in the diurnal decrease of acidity, is less effective at the lower temperatures. Rising temperature, especially above 30° C., decreases acidity when this is initially high, but does not wholly inhibit its production. Acidity tends to decline with excess of oxygen and to increase with deprivation thereof. While excess of oxygen raises the carbon dioxid-oxygen ratio, this ratio remains stationary or decreases in its absence. Wounding causes an increase

in acidity related to its extent. The acid content does not vary greatly with age, except in very young tissue. The actual rate of carbon dioxid production is greatest in the youngest tissues, next in the old turgid joints, and least in the flaccid joints, the gas interchange ratios varying according to the acidity conditions rather than according to the age of the tissue. In general, high acidities, high evolution rate of carbon dioxid, and high carbon dioxid-oxygen ratios are associated. No difference of acidity was found between the base and the tip of the joint, but most of the acid was held in the layers of soft, highly turgid cells outside the bundle ring. Some discussion of the bearings and implications of the facts as observed is also given.

Localization of acids and sugars in fleshy fruits, E. Demoussy (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 15, pp. 443–445*).—Tabulated results of analyses of the juices obtained from a number of fleshy fruits by employment of graduated pressures show that the increase of acidity and reducing sugars due to pressure, while considerable in case of a few fruits, was slight, lacking, or negative in others, so that a positive increase can not be considered as general. The variations due to pressure in case of nonreducing sugars were usually opposite in direction to those in acidity and in reducing sugars. The chemical composition of a fruit varies in different fruits in portions apparently homogeneous otherwise and in spite of the fact that they may have the same proportion of water, which appears to circulate more readily than do certain solutes.

These studies are considered to have brought out striking conformities to the law announced by Maquenne (E. S. R., 8, p. 844), according to which soluble bodies tend to accumulate at points in the living organism where there is a lowering of the osmotic pressure. This law is used to explain such phenomena as the accumulation of acid in certain portions of fruits during the process of cooking.

What are chondriosomes? D. M. Mottier (*Abs. in Science, n. ser., 43 (1916), No. 1104, pp. 286, 287*).—In addition to the chondriosomes occurring in higher plants, which become leucoplasts in case they occur in the roots and chloroplasts when in the stems, the author calls attention to the presence in cells of certain plants of other bodies similar in structure and reaction which do not develop into either leucoplasts or chloroplasts. These bodies are said to be always present in the form of granules or delicate rods, and, as they are permanent organs, they should be given morphological rank. They do not arise from the nucleus, and the question is raised as to whether the term chondriosome should be applied to the organs under discussion.

Rapid methods for quantitative and qualitative studies on the soil flora, T. F. Manns (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 288*).—For the rapid study of soil organisms, the author suggests the use of a mechanicl shaker, in conjunction with suitable media. It is claimed that where the shaker was used it was possible to plate 16 soils in duplicate plates with 2 dilutions on four different media in from 2½ to 3 hours. Usually three media will suffice to bring out the important groups, one for the ammonifying organisms and the saprophytic forms, including molds, etc., a second for *Bacillus radicicola*, and a third for Azotobacter, *B. radiobacter*, and nitrifiers.

Media for quantitative and qualitative studies on Azotobacter and nitrifiers, T. F. Manns (*Abs. in Science, n. ser., 43 (1916), No. 1104, pp. 288, 289*).—In making a survey of the bacteria in various groups of soil organisms, the author found that a soil extract agar, to which was added 0.5 gm. of a mixture of insoluble salts, would bring out the nitrogen-fixing organisms and the nitrifying organisms.

Peat organisms that slowly liquefy agar, T. F. MANNS (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 289*).—While making a study of the flora of raw peat and muck, the author observed that certain colonies of bacteria were able to break down the agar and cause a deep pitting in the medium. The organism appears to be a micrococcus and to be most abundant in peat that is composted with ground calcium phosphate and calcium carbonate.

The transmission by maize seeds of the effects of detasseling, E. HECKEL (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 12, pp. 338–340; Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 50, pp. 570–572*).—Following up his previous work (E. S. R., 33, p. 426), the author took four strains of Giant Serbian maize bred during the previous four years, the stalks being detasseled each year after the accomplishment of fertilization, and after detasseling the stalks August 20, 1915, tested them at intervals for sugar, as possibly showing the cumulative effects of traumatism on the sugar content.

Each of the four series tested, while showing an increase over its control in saccharose and a decrease in glucose, showed an increase in the total of both, the greatest percentage of total increase of these sugars being obtained from the strains previously showing only moderate sweetness, and the maximum increase being attained in 24 days after detasseling. Starch was present in all the stalks that had been detasseled.

Experiments in recombining endosperm colors in corn, R. A. HARPER (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 290*).—Attention is called to the fact that well-established black races of corn, when crossed with white races, give, both in the F_1 and F_2 generations, a series of colors including dark purples, reds, blues, grays, etc. The author has undertaken a series of recombination tests, but no immediate and uniform return to the ancestral black has been obtained as yet.

The chlorophyll factors in Lychnis dioica, G. H. SHULL (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 290*).—According to the author, three Mendelian factors are responsible for the chlorophyll of the normal dark green biotypes of *L. dioica*. One of these differentiates all green strains from albinos and is capable only of ephemeral existence. A second, acting in conjunction with the first, produces a form with possibly two-thirds as much chlorophyll as the normal. The third factor acts in conjunction with the other two to produce the full green color.

Orthogenetic saltation in Nephrolepsis, R. C. BENEDICT (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 292*).—The author describes some forms of discontinuous variation in *N. exaltata bostoniensis*. In this variety there are said to be at least three distinct lines of variation, progressive dwarfing, progressive increase in division of leaf, and progressive increase of waviness of leaf, each variation being represented by a number of forms.

Evidences of hybridism in the genus Rubus, C. S. HOAR (*Abs. in Science, n. ser., 43 (1916), No. 1104, pp. 290, 291*).—The author presents morphological data considered to favor strongly the occurrence of widespread hybridism in the genus Rubus. There is believed to be good evidence from the standpoint of extreme variability and correlated gametic sterility of widespread natural hybridism in this genus.

An interesting modification in Xanthium, C. A. SHULL (*Abs. in Science, n. ser., 43 (1916), No. 1104, pp. 292*).—A peculiar modification of burs of Xanthium is described, in which the number of the flowers surrounded by the involucre has been greatly increased. The manner in which the form originated is unknown, but it is thought to be either a mutation or a reversion from *X. canadense*.

Transmissibility of characters acquired by plants grown in salt water, P. LESAGE (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 15, pp. 440–442*).—The author, employing *Lepidium sativum*, has attempted to ascertain whether the characters acquired by plants grown in salt water and persisting in their descendants grown in the same medium for several generations, will persist also when their progeny are grown in fresh water. One year's tests are said to have given positive results and are considered to show the transmissibility by plants of characters acquired in salt water.

Pollen sterility in relation to the geographical distribution of some Onagraceæ, C. C. FORSAITH (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 291*).—Studies have been made of species of Epilobium and Zauschneria, which represent different subgenera of Onagraceæ, to determine further evidence of interspecies crossing as found in Œnothera. The results are said to show that, from a morphological standpoint, interspecies crossing is not an uncommon occurrence in this family of plants.

A remarkable new Eysenhardtia from the west coast of Mexico, W. E. SAFFORD (*Jour. Wash. Acad. Sci., 6 (1916), No. 6, pp. 133–135, fig. 1*).—The author describes *E. olivana* n. sp., and suggests the advisability of a critical study of the entire genus.

FIELD CROPS.

[Work with field crops], L. R. WALDRON (*North Dakota Sta., Rpt. Dickinson Substa., 1913, pp. 5–20, 22–31, figs. 5*).—The results of work with different field crops for a number of years are briefly reported.

Alfalfa gave an average yield of two tons per acre for the five years beginning with 1909, and in 1913 a seed production of 112.3 lbs. per acre was recorded. For the five years beginning with 1909, alfalfa in cultivated rows gave an average yield of 1.224 tons per acre and in 1909 a seed crop of 336 lbs. per acre was produced. Disking alfalfa after the first cutting did not give conclusive results, but indicated that with unfavorable moisture conditions the practice tends to increase the yield. Grimm alfalfa from home-grown seed proved to be more winter resistant than Chinook alfalfa from Montana-grown seed. In cultural tests conducted in 1913 the greater amount of seed was produced by the second growth and by thin stands in cultivated rows. Notes on cooperative alfalfa growing and on the results of some breeding work are given.

Cultural tests with sweet clover and sunflowers and a variety test with wheat are also recorded. Among other results with sweet clover a yield from Iowa seed of 524 lbs. of hulled clean seed per acre is noted. Sunflowers made a yield of field cured stalks and seeds of 4.356 tons per acre. This crop is considered of doubtful economic value for that section of the State. In a test of 24 varieties of wheat, Kubanka No. 8, descended from a single plant selected at the station in 1906, ranked first with a yield of 31.6 bu. of grain per acre.

Results of three trials with Girka wheat showed selected strains to be superior in yielding capacity to the bulk lot from which the pure lines were derived. In 1913 Victory, Silvermine, and Golden Rain ranked highest among 11 varieties of oats, with yields of 65.1, 64.5, and 63.4 bu. per acre, respectively. The same year Primus and Swan Neck barley were the heaviest yielders of 8 varieties, producing, respectively, 40.7 and 40.2 bu. per acre. The average yields of two 2-rowed and two 6-rowed varieties of barley grown for five years were in favor of the 2-rowed sorts by 45 per cent. A plat of Yaroslav emmer produced 53.8 bu. per acre and an adjoining plat of spring rye 21.3 bu. Experiments with wheat, oats, and barley in moisture conservation conducted from 1908 to 1913

showed that clean summer fallow had not been very profitable, especially with oats and barley.

Sixth annual report of the Williston substation for the year 1913, E. G. SCHOLLANDER (*North Dakota Sta., Rpt. Williston Substa., 1913, pp. 48, figs. 4*).—The results are reported of tests conducted in 1913, mainly, with varieties of spring and winter wheat, oats, barley, emmer, spelt, rye, millet, potatoes, sugar beets, and alfalfa. Cultural experiments with wheat, oats, and potatoes, principally with reference to rate and time of seeding and planting, are also reported, together with a study of hardiness in different species and varieties of medicago, including alfalfa, and meteorological observations at Williston, N. Dak., during 1913 as to temperature, precipitation, and evaporation.

[Work with field crops in 1915] (*Rhode Island Sta. Rpt. 1915, pp. 26, 27*).—Tests of varieties of potatoes showed that Clyde was not superior to Norcross and that Enohla was as early as Irish Cobbler and more productive. Norcross potatoes grown at the station did not prove as good for seed as those grown in Maine, and nothing was gained by selecting the seed from the most productive hills, although potatoes selected for two years were superior to unselected stock. The use of 2-oz. potatoes for seed planted 18 in. apart in the row gave about the same yield as planting 1-oz. pieces 9 in. apart, but the yields decreased successively when ounce pieces were dropped 12 and 15 in. apart.

Among several varieties of sweet corn planted April 28, a special strain of Early Cory produced the first pickings August 6 and 9 and yielded about 50 per cent more than commercial seed. The number of dozen ears secured on a given area by the different varieties on and before August 13 was as follows: Golden Bantam, 8; Crosby Early, 41; Quincy Market, 75; Early Cory, 99; Early Cory, special strain, 129. Experiments with three strains of White Cap corn showed no decided difference in yield between the three strains and three crosses from the same.

A yield of 30 bu. of Red Chaff winter wheat was recorded. Mammoth White Rye from Canada was not found superior to Excelsior. Sudan grass planted May 11 in drills 2 ft. apart grew fairly well on acid soil, and when allowed to stand until September 3 yielded 11.5 tons of green material. Mixing a liberal amount of hydrated or slaked lime with the surface soil and subsoil gave no larger yields of alfalfa than where such lime was mixed only with the surface soil. Alfalfa cut on June 1, July 19, and September 14 yielded a total of 4.24 tons of hay per acre as compared with 4.5 tons cut on June 24, August 14, and September 14. A mixture of orchard grass and alfalfa seeded in 1912 yielded 4.2 tons of hay as compared with 4.34 for alfalfa alone.

Crop rotations for upper Wisconsin, E. J. DELWICHE (*Wisconsin Sta. Bul. 222 (1916), 2. ed., pp. 20, figs. 16*).—The first edition of this bulletin has been noted (E. S. R., 28, p. 40). The additional statements presented point out that pasturing the first crop of clover for about two weeks in early spring, or until June 10, retards the time of cutting but without greatly affecting the yield, that in a 3-year rotation for dairy farms manure may be applied on new clover fields in the fall or winter, and that in other rotations corn and potatoes should not follow each other.

Experiments with corn, C. F. NOLL (*Pennsylvania Sta. Bul. 139 (1916), pp. 23, fig. 1*).—These experiments included trials of varieties grown for grain and for silage, tests of selection and care of seed, and breeding work, mainly ear-to-row selection, inbreeding and crossing inbred strains, and crossing varieties. The results of the variety tests are regarded as applicable only to sections of the State with conditions similar to those existing at the station.

For central Pennsylvania, the northern counties with an altitude not quite so great as that of the station, and for the higher altitudes of the southern

counties, Minnesota 13, U. S. Selection 133, 90-Day Clarage, Murdock Yellow Dent, Wisconsin No. 7, and Holmes White-Capped Yellow Dent, varieties grown for grain, and 100-Day Bristol and Reid Yellow Dent, varieties suited for silage, are recommended for trial.

In the selection and care of seed only ears showing perfect germination were planted, and yields were secured from perfect stands. Seed selected on the stalk germinated better than seed selected at husking time in an indoor test in the single year for which the record was kept, but the seed selected at husking time in the three years' trials gave the better field germination, and there was not much difference in the yields. Heavy seed gave a little better field germination and a somewhat better yield than light seed. While seed from ears germinating quickly gave the better field germination, the difference in yield was within the limits of error. Keeping the seed at living room temperature during the winter resulted in better germination indoors and in the field than was obtained with seed kept without artificial heat, but the difference in yield was insignificant.

Ear-to-row breeding of one variety followed by crossing of remnants of the best yielding ears, as shown by yields of seed from the best ear rows and from crosses of the best ears, did not materially increase the yield. Inbreeding very much reduced the size of stalks and yield, while crossing of inbred strains not closely related restored the vigor and productive capacity. Of eight first-generation crosses only two outyielded the better parent, the difference in yield being but little.

The development and properties of raw cotton, W. L. BALLS (*London: A. & C. Black, Ltd., 1915, pp. XII+221, pls. 16, figs. 22*).—The main purpose of this book, it is stated, is to present the history of the development of cotton-lint and, accessory to this purpose, to indicate the development of the plant on which this lint is borne. The chapters presented discuss the development of pedigree, the growth of the cotton plant and the factors which affect it, the structural development of the boll and how this may be influenced by environment, the production and preparation of commercial lint, the growth of cotton culture, and the methods employed in studying and improving the crop. Tables of statistical data are appended.

Note on the classification of the rices of Lower Burma, R. A. BEALE (*Reprinted from Poona Agr. Col. Mag., 7 (1915), No. 2, pp. 10*).—Schemes of classification proposed by Kikkawa and Graham among others are briefly discussed, and the botanical characters of rice important in the classification of varieties are enumerated and described. Agricultural characters in themselves are considered an inadequate basis for classification, as they are affected by environment but are regarded of value in this connection only when used in conjunction with botanical characters. A tentative scheme for the classification of the rices of Lower Burma is proposed.

The culture of rice in Spain, H. JUMELLE (*Inst. Colon. Marseille Bul. 1 (1914), pp. 28, fig. 1*).—This bulletin is a popular discussion of the ordinary field practice in the culture of rice as applied in the Province of Valencia in Spain. Statistics of production and marketing are also given.

Annual report of the Bureau of Sugar Experiment Stations, E. G. E. SCRIVEN (*Ann. Rpt. Bur. Sugar Expt. Stas. [Queensland], 1915, pp. 52*).—This report reviews the progress of the cane-sugar industry of Queensland and the production of cane and sugar in 1915. The experimental work carried on at the Central Sugar Experiment Station at Mackay, the Southern Sugar Experiment Station at Bundaberg, and in other parts of the State, is briefly noted.

Experiments were conducted to determine the best system of treating ratoons. The different treatments included leaving the trash on the ground and allowing the cane to volunteer, burying the trash between the rows, shifting the trash in every other space between the rows and cultivating the cleared spaces, and burning the trash and opening the middles with plow and subsoiler to a depth of from 16 to 18 in. Under the conditions of a severe drought, leaving the trash gave the best results, but the preceding year, when conditions were normal, burning the trash and giving deep cultivation, which is the station method, proved most profitable. It is concluded from the results that plowing under trash in the ratoons does not pay.

The results of a variety test showed that Q 813 ranked first in sugar content followed by Q 990 and Q 137. Experiments with canes from the Queensland Acclimatization Society were continued and the second ratoon crop was harvested. Badila Seedling and Hybrid No. 1 gave the highest percentage of pure, obtainable cane sugar.

Different cultural methods compared resulted in the highest total yield of plant crop of 1914 and the first ratoon crop of 1915 on the plat giving shallow cultivation with broad hoes and on the one cultivated with a light drill harrow fitted with straight sharp tines. In a test to determine whether cane sets cut from arrowed canes have a prejudicial effect on the germination and subsequent yield, it was found that the cane from arrowed cane sets not only produced a greater stand of cane but also a greater yield.

Analytical tests to determine the commercial value of a number of generally grown varieties showed that HQ 426 and Badila gave much better yields of pure obtainable cane sugar than Goru, Cheribon, Malabar, and Otamite. Early or late planting apparently had no effect on the average sugar content of Cheribon, Malabar, and Otamite, while in the other three varieties the late planting gave better average analyses. In a second test HQ 426 and Badila also ranked first.

The Mackay station laboratory reported tables of analyses showing the quantities of lime, potash, phosphoric acid, and nitrogen removed in crops of cane of the weight grown. It was shown that more potash is removed than nitrogen, lime, and phosphoric acid.

At the Southern Sugar Experiment Station at Bundaberg, planting cane in rows 5, 6, or 7 ft. apart showed that the closer planting produced the better yields. It was further found that planting tops only gave much better results than planting middles or bottoms and middles. The results of cultural tests were in favor of subsoiling but the cost was too high to be profitable. Cane volunteered through trash, owing to a dry season, gave the largest margin of profit, but this method is not advised as under normal conditions cultivation usually gives much better results. Analyses of burnt canes indicated that the cane did not depreciate to any extent during the first 48 hours, after which the glucose content began to increase rapidly until the tenth day, when it had increased almost twenty times as much as in the original. The loss in weight of cane and in the purity of the juice was also considerable.

Planting sprouted cane cuttings, J. Schuit (*Arch. Suikerindus. Nederland. Indië, 23 (1915), No. 12, pp. 461–466; Meded. Proefstat. Java-Suikerindus., 5 (1915), No. 5, pp. 178–182*).—This article describes the method of planting sugar cane with cuttings in which the buds have made some growth, as distinguished from the usual method of using cuttings in which the buds have not yet started. Directions are given for the production of cuttings and for handling, treating, and planting them.

Sweet potato culture for the southern planter, C. CROW and C. W. WAUGHTEL (*Seville, Ga.: Crow & Brogdon, 1915, pp. 103, pls. 12, fig. 1*).—A popular treatise on sweet potato culture, including descriptions of the various phases of the work and devoting a chapter to commercial sweet potato plant growing in Florida.

Timothy: Its history, culture, and variability, and breeding work carried on with the plant at Svalöf, H. WITTE (*Sveriges Utsädesför. Tidskr., 25 (1915), Nos. 1, pp. 23–44; 4, pp. 143–182; 5, pp. 199–221, figs. 26*).—This article presents historical and cultural notes regarding timothy, reviews breeding work with the plant carried on in different countries, discusses its different forms, describes the technique and the method employed at Svalöf in breeding perennial grasses, particularly timothy, and reports results secured together with deductions drawn from them. It is pointed out that since timothy is cross-fertilized and is also very variable, it is impracticable to base its improvement on the selection of homozygous individuals.

In the breeding work it was found that in length of stem the plants varied from 20 cm. to over 100 cm. The heritability of the length of stem was indicated by the experimental results. The number of internodes varied only from 5 to 7 but in length the internodes showed great variations. In some forms the upper internode constituted more than half and in others only one-fourth of the stem length. The lower internodes were quite short in some cases and in others comparatively long. The thickness of stem varied for the different forms but no correlation with the length of stem was established. The shape or form of the stem was found to vary to a considerable extent and appeared to be a heritable character.

Most forms showed a habit of stooling densely, but some stooled quite loosely due to the development of culms from the leaf axils of the preceding generation of sprouts. The leaves varied in length and width and also in shape, some forms having soft and pendant blades while in others the blades were stiff and erect.

The spike in the different strains ranged in length from about 2 to 15 cm. and in thickness from approximately 4 to 10 mm. Correlation between length and width of spike and between length of spike and stem was not established. The spike was generally cylindrical but forms with the greatest diameter either at the base, the point, or the middle were found. In some forms the spike was loose and pendant, while in most cases it was stiff and erect with the spikelets densely set. The spikelets in certain strains were not entirely united with the central axis of the spike, which gave to the head a rough or minutely branched appearance. This also proved to be a heritable character, but the author points out that from a practical standpoint the length and density of the spike are mainly of value.

The floral parts and the fruit also presented many variations. At Svalöf no differences in winter resistance were observed but in the extreme northern part of Sweden marked differences in this respect were found to exist. Variations were also determined in regard to sprouting, time of blossoming, strength of culm, time of withering of leaves, quantity and quality of second growth, rust and drought resistance, and the length of the period of productiveness. The degree of adherence of the glumes to the ripe seed varied with the different forms and the practical bearing of this character is dwelt upon. The characters of strains of timothy requisite for profitable temporary and permanent meadows, and for satisfactory seed and forage production, are enumerated.

The results of tests with new strains of timothy showed that No. 237a, or Primus, produced a yield 16.7 per cent greater than commercial sorts, while No. 217 yielded 6.7 per cent more than Primus.

Tobacco seed beds, F. CHARLAN (*Canada Expt. Farms Bul. 21, 2. ser. (1915), pp. 51, pls. 3, figs. 13*).—This bulletin is a popular treatise on the preparation, care, and management of tobacco seed beds. Detailed temperature records of hotbeds, semihotbeds, and greenhouses are appended.

On the inheritance of some characters in wheat, II, A. and G. L. C. HOWARD (*Mem. Dept. Agr. India, Bot. Ser., 7 (1915), No. 8, pp. 273–285, pls. 9*).—In previous work along this line (E. S. R., 28, p. 638), it was assumed in view of the results secured that in the crosses between bearded and beardless wheats the bearded parent had two factors, one capable of producing short awns or tips only and the other, when acting in conjunction with the first, resulting in fully bearded plants. To obtain further data on the subject the cross was continued to the F_4 generation, in which the behavior of selected plants confirmed the results of the third generation. The forms with long tips and short tips as well as the bearded and beardless plants bred true.

For the further study of these factors short-tipped and long-tipped forms isolated from the F_4 of a cross between P 22, containing the two factors producing the fully bearded character, and A 88 (entirely beardless) were recombined, and P 6, a wheat apparently carrying the long-tipped factor, was crossed with P 7 which seemed to have short tips. In the recombination of the bearding factors of P 22, the F_1 plants were almost beardless while 59 plants in the F_2 ranged from 4 beardless to 4 fully bearded. In the cross of P 6 with P 7 the procedure was the same and the results were similar.

Two other cases of a cross between a bearded and a good beardless form were studied. Punjab Type 9, a bearded wheat, was crossed with Pusa 4, an entirely beardless form, and in the F_2, 610 plants were examined. Of these, 39 were beardless and 571 were awned to varying degrees ranging from fully bearded to minutely tipped. Similar results were obtained in crossing BXI 77, a fully bearded form, with Pusa 4. The ratio of bearded to beardless forms is regarded as indicating the existence of two factors in the bearded parent.

It was observed that the development of a bearded or beardless character was not always uniform, especially in the case of cultures breeding true to long or short tips. The first formed and largest ears had the longest awns, while those produced later had almost no awns. It is stated that well-grown cultures develop tips normally and present no difficulty in deciding whether the tips are long or short, while in weaker growth the tips do not develop well and care is necessary to distinguish their nature. It is further found that observations on bearding are best made when the ears are still green and just before the chaff begins to change in color. In order to grow complete cultures from any particular plant it is advised to sow the grain in boxes and then transplant the seedlings into the field, as in this way little or no loss of plants occurs.

Studies were also made of felted and smooth chaffs as heritable characters. A microscopical study of the chaff of Punjab Type 9 revealed long silky hairs and much shorter ones. An analysis of the F_3 and subsequently of the F_2 generation resulted in the isolation of these two kinds of hairs and in the proof that each kind is inherited separately. Three crosses were made which resulted in the proof that the felting in Pusa 4 is identical with that in BXI 77 and that the felting in both these cases is identical with the short chaff hair character in Punjab Type 9.

Some observations on the occurrence of sterile spikelets in wheat, A. E. GRANTHAM (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 6, pp. 235–250, pl. 1; abs. in Science, n. ser., 43 (1916), No. 1104, pp. 289, 290*).—The results of an examination of a large number of varieties of wheat with reference to sterility of spikelets made at the Delaware Experiment Station in 1915 is noted.

It was found that the varieties grown under field conditions exhibited a higher percentage of sterile spikelets than where the plants were grown 6 in. apart each way as under the centgener method. The average number of sterile spikelets in 25 spikes of each variety and the percentage to the whole number of spikelets were determined for 80 beardless and 108 bearded varieties of wheat. The average percentage of sterile spikelets in the bearded varieties was found to be 24.1 per cent, while the beardless averaged 17.8 per cent. Only 20 of the 80 beardless varieties had more than 15 per cent of sterile spikelets, while not a single variety of bearded wheat had less than 17 per cent. Forty-five of the 108 bearded varieties had 25 per cent or more sterile spikelets, while of the 80 beardless varieties only 2 had 25 per cent.

A study of a bearded and a beardless variety planted at 7-day intervals from September 17 to October 22 on fertilized and unfertilized soil showed that the earlier planting, regardless of soil fertilization, had a higher percentage of sterile spikelets than the later seeding. In this case also the bearded variety had the higher percentage of sterile spikelets.

Two varieties of wheat fertilized with different combinations and quantities of plant food exhibited considerable variation in the sterility of the spikelets. Phosphoric acid and potash used singly developed a higher percentage of sterile spikelets than nitrogen where two of the plant-food elements were used in combination. Nitrogen and potash showed the smallest percentage and phosphoric acid and potash the highest. The untreated plats were comparatively very low in the percentage of sterile spikelets produced.

Correlation studies indicated that the longer the spike the greater the number of sterile spikelets is likely to be.

HORTICULTURE.

Horticultural investigations.—A retrospect, L. C. Corbett (*Proc. Soc. Hort. Sci., 11 (1914), pp. 64–70*).—A short retrospect of horticultural investigations in the United States. The various lines of endeavor are grouped into the following general classes and discussed: Theoretical considerations, systematic studies of horticultural groups, variety tests, descriptive expositions, surveys of a statistical or economic nature, and special industrial problems.

Some problems connected with killing by low temperature, W. H. Chandler (*Proc. Soc. Hort. Sci., 11 (1914), pp. 56–63*).—A discussion of the cause and nature of killing of plant tissue by low temperature, with special reference to injury to fruit trees. A bibliography of cited literature is included.

Hotbeds and cold frames, C. S. Adams (*Kentucky Sta. Circ. 11 (1916), pp. 3–22, figs. 13*).—Popular directions are given for the construction and management of hotbeds and cold frames.

Spraying calendar, E. P. Taylor and M. A. Willis (*Idaho Sta. Circ. 1 (1916), folio*).—This calendar contains directions for the control of the more important insect pests and plant diseases, together with formulas for the preparation of the principal sprays.

The farm vegetable garden, A. G. B. Bouquet (*Oregon Sta., Bien. Rpt. Hood River Sta., 1913–14, pp. 33–39*).—Practical suggestions are given for the construction and management of a hotbed, together with suggestions relative to the production of various vegetables including varieties recommended for general use and for canning.

Preliminary report on celery storage investigations, H. C. Thompson (*Proc. Soc. Hort. Sci., 11 (1914), pp. 19–18*).—A test of different types of crates as influencing the keeping quality of stored celery indicates that in order to lengthen the storage period for celery it is desirable either to use crates much

narrower than the standard crates or to furnish a ventilating partition through the center of the standard crates. The narrow crates gave somewhat better results as to keeping quality than the ventilated crates. The limit of keeping quality for celery packed in standard crates and stored under the best conditions is given as 2.5 or 3 months, as compared with at least 4 months for the small or ventilated crates. Aside from their superiority as regards keeping quality small crates are also recommended because of their ease of handling and greater durability in transportation.

Temperature readings taken in five cars of celery en route to market show that there is quite a difference in temperature at different heights in the car, both in the ends and in the center. There is also quite a difference in temperature between the ends and center of the car and between the air and celery temperature at the same location. The temperature records are so similar to those secured with fruit in transit that the author believes precooling will prove just as valuable in preventing decay in the shipment of vegetables as in the shipment of fruit.

The temperature records secured during the past two years and observations in a large number of storage houses during the past three years have led the author to conclude that celery is never inactive while in storage. Normal maturing processes go on in storage even at a temperature of 31 or 32° until the celery is ripe. Decomposition then commences and never stops until the celery is completely decomposed. Where the temperature is maintained between 30 and 32° the rate of ripening and decomposition is slow. With higher temperatures or with fluctuating temperatures the storage period is much shorter.

Fertilizer experiments with kale, T. C. Johnson (*Proc. Soc. Hort. Sci., 11 (1914), pp. 18–24*).—A progress report on experiments under way at the Virginia Truck Experiment Station (E. S. R., 30, p. 532) to determine the best methods of treating truck lands in the vicinity to maintain their fertility.

An investigation in tomato breeding, F. S. Reeves (*Proc. Soc. Hort. Sci., 11 (1914), pp. 24–26*).—A brief statement of results secured the first year in an attempt to cross the tomato with *Solanum balbisii* to get a frost-resistant tomato suitable for conditions in Ontario.

Study of the inheritance of size and productiveness in pedigreed strains of tomatoes, C. E. Myers (*Proc. Soc. Hort. Sci., 11 (1914), pp. 26–33*).—Initial selections from a number of varieties of tomatoes were made in 1911 with the view of studying the inheritance of size and productiveness. The present paper comprises a study by the statistical method of a number of plant selections within the variety Earliana. Although the experiment has not been conducted sufficiently long to warrant definite conclusions, it is believed that the data presented indicate the feasibility of improving the tomato crop by careful selection.

See also a previous note (E. S. R., 34, p. 146).

Horticultural investigations, C. I. Lewis (*Oregon Sta., Bien. Rpt. Hood River Sta., 1913–14, pp. 25–33*).—Notes are given on some orchard fertilizer experiments in which the ingredients are being applied both in the dry form and in solution. No definite conclusions are drawn from the results, which represent only one year's work. The data thus far secured indicate, however, that orchard trees may be benefited by spraying with certain fertilizer solutions. In one experiment, here noted, spraying with a solution of nitrate of soda and caustic soda resulted in a better color of foliage, as well as a better growth of fruit and wood, than on plats where nitrate of soda was broadcasted dry or sprayed on the ground in solution. An increased yield of fruit and a decrease in the number of the smaller apples were also observed on the trees sprayed with

the solution. The increase in size of the apples was accompanied by an apparent dropping off in color.

Experiments have been conducted for three years, in which alfalfa and clover were grown as orchard shade crops. The results thus far secured, although not decisive, suggest that where irrigation is done well and a sufficient amount of moisture is maintained in the soil trees will improve in vigor where alfalfa or clover is grown among them. On the other hand, in the absence of sufficient moisture the shade crops will use the moisture at the expense of the trees.

Further results with dynamite for tree planting, A. J. Farley (*Proc. Soc. Hort. Sci., 11 (1914), pp. 127–130*).—The author gives additional data secured in planting apple and peach trees with dynamite (E. S. R., 32, p. 535), together with the results secured from planting pear trees with dynamite.

Summing up the results secured during the past three years, it is found that with peach trees planted at Vineland by the use of dynamite there has been a noticeable advantage in the amount of branch and twig development over trees set in the usual manner. With the exception of the first season there has been a corresponding advantage in the circumference of the trees. A similar advantage in branch and trunk development of peach trees planted with dynamite at New Brunswick observed during the first season has not been maintained during the second and third seasons. On the contrary, the advantage is now in favor of the undynamited trees. The only variety producing a profitable crop during the third summer was the Carman. The crop of this variety showed sufficient increase in favor of dynamiting to be worth more than enough to pay for the cost of the dynamite used in planting. This was not true in the case of the varieties Stump and Elberta.

The difference in twig and trunk circumference has not been so great with apple trees as with peach trees. Pear trees after two years' growth showed a slight advantage in favor of dynamiting. Trees planted with dynamite have developed a deeper root system than trees planted by ordinary methods. The cost of planting trees with dynamite was from 4 to 5 cts. per tree greater than the cost of ordinary planting.

Summing up the experiments as a whole, it is concluded that in the majority of cases the increased growth and fruit production recorded on dynamited trees is not great enough to make up for the increased cost and danger involved in planting. The use of dynamite is not recommended for tree planting on those soils that are naturally adapted to orcharding.

Report of committee on score cards, W. H. Alderman (*Proc. Soc. Hort. Sci., 11 (1914), pp. 43–52*).—The present report represents the findings of the committee on score cards of the Society of Horticultural Science, with special reference to ideal sizes for exhibition purposes for the several varieties of apples grown in the United States and Canada.

The study of apple tree characters and its bearing on variety substitution, J. K. Shaw (*Proc. Soc. Hort. Sci., 11 (1914), pp. 120–127*).—This comprises a brief survey of some of the tree characters of apples that are of value in identifying varieties, together with descriptions of a number of varieties of apples intended to apply to trees from the age of two to five or six years as they appear during late summer or early fall.

Factors correlated with hardiness in the apple, F. W. Allen (*Proc. Soc. Hort. Sci., 11 (1914), pp. 130–137*).—The author reports studies of twigs representing varieties from several sections of the United States and Canada, but chiefly from a small nursery planted for this purpose on the Iowa Experiment Station grounds. About 33 varieties were included in the test.

Observations made relative to the factors of maturity and water content show that the hardiest varieties mature their wood from a few days to several

weeks ahead of the less hardy sorts. The hardier varieties function during the growing season with a smaller amount of water in their tissues. During a spell of very severe weather they retain their more concentrated cell sap and are not dried out so readily by the continued cold. By taking notes on maturity and making tests to determine the rate of transpiration and the freezing point of the cell sap, the author believes that a pretty accurate idea of the tree's hardiness can be obtained.

Studies of the structure and composition of the wood suggest that there is some correlation between the thickness and structure of the bark and the rate of evaporation, although the figures obtained from a large number of examinations are not conclusive. In some cases the maximum thickness of the bark of the more tender varieties exceeded the minimum thickness of bark of the hardier varieties. The amount of stored food contained in the twigs appeared to bear some relation to hardiness, although exceptions were noted. Observations relative to the size of the blossoms indicate that none of the varieties possessing large size and thickness of petals is tender. On the other hand, hardy varieties do not always have the thickest petals. Tests made relative to density of wood, although not conclusive, indicate that there is some correlation between density and hardiness.

Freezing tests were conducted to determine, if possible, the temperature at which the various varieties would be injured under a given condition and also to determine the relation between the moisture content and the ability of the twig to withstand cold. The results secured with a number of varieties are given. In general the twigs were found to be either killed or seriously injured when suddenly subjected to a very low temperature, even though it was for a short time. A longer period of moderate cold slightly injured the hardier varieties and killed most of the tender varieties.

The relation of climate to varieties of apples, R. M. WINSLOW (*Proc. Soc. Hort. Sci., 11 (1914), pp. 137–148*).—The author presents data showing the main features of the growing seasons of different sections of British Columbia, including temperature and rainfall observations and notes on the adaptability of the more important varieties of apples to climatic conditions in the different sections.

A preliminary consideration of one phase of meteorological influence on plants, indicated by hand pollination of several commercial varieties of apples, W. F. FLETCHER (*Proc. Soc. Hort. Sci., 11 (1914), pp. 116–119*).—During the 6-year period, 1905 to 1910, the author conducted hand pollination tests in an orchard in the Shenandoah Valley with several commercial varieties of apples in different combinations of meteorological conditions. The results from this work led him to the following conclusions, which are here presented to indicate a line of research which has received little attention:

"The sterility or fertility of apple blossoms depends largely upon local conditions. In this statement due allowance is made for the tendencies of different varieties toward light or heavy crop setting character or productivity. The affinity between two varieties is governed by local conditions immediately attendant on pollination. Periods of rapid evaporation, that is, high temperatures, strong winds, and dry air at the time of receptivity of the stigmas are detrimental to the setting of fruit. The shock or the effect of undue exposure to the pistils previous to their natural opening or at the time of receptivity is so great and varies so much under slight changes of atmospheric conditions as to negative all comparative work in hand-manipulated cross pollination."

Osmotic relationships and incipient drying with apples, W. H. Chandler (*Proc. Soc. Hort. Sci., 11 (1914), pp. 112–116*).—The results are given of some preliminary experiments conducted by the author and A. J. Heinicke relative to incipient drying of both leaves and fruit of the apple.

The data secured show a fairly large incipient drying in the leaves of apples and an appreciable incipient drying in the fruit. The incipient drying shows earlier with the leaves than with the fruit, and the leaves recover moisture under favorable conditions much faster than the fruit. Moisture determinations of detached and attached fruits show conclusively that the loss of water from the fruits was due to its being drawn from the fruits toward the leaves rather than to evaporation. Although the author does not consider the effect of large leaf surface in drawing water from the fruits at times to be a determining factor so far as size of fruit is concerned, it is suggested that this effect may enter as one of the many possible sources of error in the interpretation of experiments dealing with orchard culture problems.

Experimental results in young orchards in Pennsylvania, J. P. Stewart (*Proc. Soc. Hort. Sci., 11 (1914), pp. 101–111*).—The substance of this paper has appeared in a subsequent bulletin of the Pennsylvania Experiment Station (E. S. R., 33, p. 238).

A fertilizer experiment with peaches, C. A. McCue (*Proc. Soc. Hort. Sci., 11 (1914), pp. 86–91*).—A progress report on a long-time experiment with peaches being conducted at the Delaware Experiment Station to determine the effect of certain plant food elements upon the physiology of the tree. At the time of this report the experiment had been running for seven years.

Observations that have been made of the effect of different fertilizing elements upon color of fruit led to the tentative conclusion that any effect of nitrogen, potash, or phosphoric acid upon color is secondary. For example, the deficiency in color in plats heavily fertilized with nitrogen is attributed to the profuse growth of foliage shutting off the light rather than to the direct effect of the nitrogen. The potash plats had practically the same intensity of color as the check plat. Heavy applications of phosphoric acid appear to have a somewhat deadening effect upon color without decreasing the actual amount of color. Trees that were treated with nitrogen or combinations of nitrogen and potash are characterized by their general thriftiness.

Tests thus far made with reference to the keeping quality of the fruit from the various plats indicate that potash has some beneficial effect in increasing the period of soundness of the fruit. Heavy phosphoric acid applications delayed ripening about two days and potash hastened it one day. Nitrogen either in combination or alone delayed ripening from a week to ten days. With combinations of nitrogen and potash the retarding effect of the nitrogen is dominant. Observations thus far made do not show any effect of fertilizers on the time of blooming. The results relative to the effect of fertilizers upon the time of wood ripening in the fall are inconclusive but indicate, contrary to common opinion, that heavy applications of nitrogeneous fertilizers do not make a soft immature wood. It is suggested that the regulation of the soil moisture has a more intimate connection with fall ripening of wood and bud than does plant food. As in the case of color of fruit, light appears to be the most important factor influencing the color of twigs. Although no definite conclusion can be made at this time, tests made for several years of pollen from the various fertilizer plats suggest that plant food does have an effect upon the viability and longevity of the pollen.

Data are given showing the calculated yields per acre from the different plats during the three years, 1912 to 1914. Heavy applications of nitrate of soda have been beneficial to fruit production. Still better results have been

secured where potash was combined with nitrogen. Records of costs and receipts from the various plats show in brief that the larger the amount of nitrogen used per acre the greater were the financial returns upon the investment.

The effect of certain mineral fertilizers upon strength of wood in the peach tree, C. A. McCue (*Proc. Soc. Hort. Sci., 12 (1915), pp. 113–118*).—In connection with the above noted experiment tests were made to determine the effect of certain plant food elements upon strength of wood in peach trees.

The results thus far secured have failed to throw very much light upon the influence of nitrogen, potash, and phosphoric acid in strengthening or weakening wood structures. Almost as much variation was found in the strength of wood from any one block of trees as in the averages for the different blocks. The author is of the opinion that even greater differences in strength of wood can be obtained by different pruning methods than were obtained by different fertilizer treatments.

Methods and results in grape breeding, R. D. Anthony (*Proc. Soc. Hort. Sci., 11 (1914), pp. 81–86*).—The author discusses some of the points observed in the course of breeding investigations conducted by various investigators during the past 25 years at the New York State Station and summarizes some of the more important results secured in these investigations. The results of the work have been similarly summarized in a paper previously noted (E. S. R., 33, p. 641).

Recent work with Vitis vinifera in New York, U. P. Hedrick (*Proc. Soc. Hort. Sci., 11 (1914), pp. 77–81*).—Experiments started at the New York State Station in 1911 with 101 varieties of European grapes have shown that many varieties of the European grape can be grown in the eastern United States, providing they are grafted on phylloxera-resistant stocks and given winter protection.

Two methods have been employed in protecting the grapes. In one the vines have been covered with a few inches of earth; in the other the vines have been wrapped with straw. The earth covering was the cheapest and most efficient method.

Of 85 varieties of *V. vinifera* now fruiting on the station grounds a considerable number are here listed as worth trying on a larger scale. In view of the larger yields secured from European grapes as compared with our native grapes, attention is called to the desirability of carrying on experiments with special reference to the cultural requirements of *V. vinifera* in eastern America.

Growing and grafting olive seedlings (*California Sta. Bul. 268 (1916), pp. 303–326, figs. 14*).—This bulletin consists of two parts.

I. *Growing olive seedlings, F. T. Bioletti and W. F. Oglesby* (pp. 305–321).—The results are given of experiments conducted to determine a method of separating good seed from poor, the best preliminary treatment of seed to facilitate germination, and the best conditions of planting to promote quick and uniform germination. Most of the germination tests were made with the Redding variety. Based on the results as a whole, a simple and rapid method of raising Redding seedlings for grafting stock is recommended in substance as follows:

The perfectly ripe fruit should be soaked in a 3 or 4 per cent soda lye for several hours to soften the skin. After washing off the lye the pulp can be removed by rubbing through a wire sieve of $\frac{3}{16}$ in. mesh. The clean seed is placed in a 25 per cent brine solution and all floating seed rejected.

Of various methods tested for facilitating germination clipping the apex or pointed end of the seed has given the best results. This is done with a clipper specially designed to prevent injury to the seed. The clipped seed is planted

about 0.125 to 0.25 in. deep directly in flats containing a light porous soil, the surface of the soil being covered with a light layer of sifted moss or similar material.

The planted flats are watered only sufficiently to prevent a complete drying out of the layer around the seed. The warmer they are kept the more rapidly the seed will germinate and grow. Some of the seedlings come up in four or five weeks, others continue to come up for two, three, or more months. The seedlings are transplanted into beds at the end of about five months, or when they are about 4 or 5 in. high.

The potted seedlings are kept in a greenhouse, lath house, or other protected place until the following spring when they can be planted in the nursery. They may be budded in the autumn or grafted the next spring.

II. *Grafting olive seedlings, F. T. Bioletti and F. C. H. Flossfeder* (pp. 322-326).—The results are given of experiments conducted to determine a good method of tying, waxing, and covering nursery grafts. The method giving the best results consisted in tying the grafts with a cotton string without waxing and covering with soil to the top of the scion. When the grafts were covered deeply waxing proved to be detrimental.

Heredity studies with the carnation, C. H. CONNORS (*Proc. Soc. Hort. Sci., 11 (1914), pp. 95-100, fig. 1*).—A discussion of the results secured in the author's breeding work at the New Jersey Experiment Stations.

The work thus far conducted shows "that in crossing a yellow carnation with white, red being present as a latent character, white is dominant over yellow and red. In the second generation, yellow will be dominant over red unless the red be strongly evidenced, in which case red is dominant over yellow. In some yellow carnations the presence of red is associated with the presence of perfect sexual organs. The probability of two kinds of white, homozygous and heterozygous, as dominants is strongly suspected."

The humidity factor in rose culture, M. A. BLAKE (*Proc. Soc. Hort. Sci., 11 (1914), pp. 92-94*).—The substance of this paper has been included in a subsequent bulletin of the New Jersey Experiment Stations noted (E. S. R., 34, p. 44).

FORESTRY.

Michigan manual of forestry.—II, Forest valuation, F. ROTH (*Ann Arbor, Mich.: Author, 1916, vol. 2, pp. V+171, figs. 7*).—The present treatise on forest valuation comprises part 2 of the author's manual and text-book of forestry (E. S. R., 32, p. 46). The introductory chapter discusses the literature, scope, application, and history of valuation. The succeeding chapters treat in detail of the arithmetic of forest valuation, application of valuation, relation of capital and income in forestry, rotation, value of stumpage, damage in timber, taxation of forests, fire insurance in forestry, and right use of land.

Structural timber in the United States, H. S. BETTS and W. B. GREELEY (*Internat. Engin. Cong., 1915, Sept. 20-25, Adv. Copy, pp. 50, pls. 2, figs. 16*).—A paper presented at the International Engineering Congress, San Francisco, in 1915, in which the author surveys the timber resources of the United States with reference primarily to structural uses. Information regarding the species of particular interest to engineers is presented, together with a summary of the data obtained by the Forest Service of the U. S. Department of Agriculture on their mechanical properties and structural values. A brief reference is also made to grading rules and commercial specifications for structural timbers.

Laboratory tests on the durability of American woods.—I, Flask tests on conifers, C. J. HUMPHREY (*Mycologia, 8 (1916), No. 2, pp. 80–92, pl. 1*).—The author reports results of durability tests, extending over periods of 4, 6, and 12 months, of a number of American woods.

The tests were conducted in 2-liter Erlenmeyer flasks, plugged rather lightly with absorbent cotton and capped with thin muslin which had been saturated in a dilute solution of mercuric chlorid. The test blocks were placed in the flask together with "culture blocks" and then inoculated with a culture of *Lentinus lepideus*, grown on a bean pod. The "culture blocks" were irregular hemlock blocks introduced as a medium to support a vigorous growth of the fungus in order to secure a uniform and severe infection of the test blocks.

The blocks were weighed before and after the test and the percentage loss calculated from these data.

Preservative treatment of timber, H. F. WEISS and C. H. TEESDALE (*Internat. Engin. Cong., 1915, Sept. 20–25, Adv. Copy, pp. 45, figs. 3*).—This paper, presented at the International Engineering Congress, San Francisco, in 1915, comprises a general review of the results obtained in the United States in preserving wood. A partial bibliography of the subject, covering American practice, is appended.

The properties of balsa wood (Ochroma lagopus), R. C. CARPENTER (*Proc. Amer. Soc. Civ. Engin., 42 (1916), No. 5, pp. 649–679, figs. 16*).—This paper shows the microscopical structure of balsa wood and also gives various tests of its transverse and compressive strength. This wood has been used in the past as a buoyancy product for life preservers and in connection with the fenders of life boats and rafts. The various tests which were made of the insulating properties of this wood indicate that it may prove of value as an insulating material.

Notes on the ancestry of the beech, E. W. BERRY (*Plant World, 19 (1916), No. 3, pp. 68–77, figs. 2*).—A brief historical sketch of the beeches.

British Columbia Douglas fir (Pseudotsuga taxifolia) (*Brit. Columbia Govt., Forest Branch Bul. 14 (1916), pp. 15, figs. 10*).—An account of the Douglas fir, with special reference to strength values under different tests as compared with other species of structural timber.

British Columbia western soft pine (Pinus ponderosa) (*Brit. Columbia Govt., Forest Branch Bul. 17 (1916), pp. 15, figs. 17*).—An account of this species with reference to its distribution and habit of growth, characteristics, and uses of the wood.

Influence of the intensity of thinnings on the yield of young regular stands of spruce, E. MER (*Rev. Eaux et Forêts, 54 (1916), No. 2, pp. 45–53*).—In continuation of a previous report (E. S. R. 31, p. 444) the author gives the results of thinning experiments started in 1899 in which young spruce stands received thinnings of different intensities with special reference to the effect of the thinnings on yield. The results in general indicate that both early and relatively heavy thinnings act advantageously on future yield.

Manuring experiments on rubber, B. BUNTING (*Agr. Bul. Fed. Malay States, 4 (1916), No. 5, pp. 125–141*).—This comprises a progress report on experiments conducted to determine the influence of different manures on the yield of dry rubber as measured by yield records for a period of 11 months.

The differences thus far are too small to attempt comparative values on the effect of the manures. The use of lime in connection with the different elements has resulted in increased yields, a complete fertilizer to which lime was added giving considerable increase in yield. In addition to yield data records are given of girth increase and cost of manures.

Forest experiments on heath lands, C. Dalgas (*Hedeselsk. Tidsskr., 1915, Nos. 2, pp. 21–36, figs. 13; 6, pp. 74–90, figs. 14; 8, pp. 101–114, figs. 9*).—The results are given of experiments conducted in state and private plantations in the culture of different species of evergreens on heath lands.

Handling the farm woodlot, C. W. Eaton (*Univ. Me. Ext. Bul. 105 (1916), pp. 16, fig. 1*).—This bulletin deals primarily with methods of estimating woodlot timber and of selling the timber to greater advantage.

Forest planting in Wisconsin, W. D. Barnard (*Wis. Conserv. Com. Bul. 1 (1916), pp. 34, figs. 11*).—This bulletin gives an account of the reforestation work accomplished by the State and by private agencies, specific directions for reforesting land, and silvical notes on a number of important species.

Forests of Yosemite, Sequoia, and General Grant National Parks, C. L. Hill (*U. S. Dept. Int., Off. Sec. [Pub.], 1916, pp. 39, figs. 22*).—A popular descriptive account of forest types and species in these parks.

Treatment of the forests of Mexico, H. Burcez (*Dept. Bosques [Mexico] Bol. Forest. Propaganda, 2 (1914), pp. 14, pls. 3*).—This bulletin comprises suggestions relative to systems of managing Mexican forests.

Report of the forestry branch, E. J. Zavitz (*Rpt. Min. Lands, Forests and Mines, Ontario, 1915, pp. 69–89, figs. 8*).—A report on the operations of the forestry branch of the Province of Ontario for the year ended October 31, 1915. Special consideration is given to railway fire protection work.

Reports of the forestry administration for 1914 (*Skogsvårdsför. Tidskr., No. 10 (1915), Bilag. 2, pp. IV+408 figs. 27*).—This comprises reports from the various districts of Sweden relative to the constitution, management, administration, and various operations on the state forests, including a financial statement for the year.

Forest protection laws and suggestions for the development of an adequate law, K. E. Kallin (*Skogsvårdsför. Tidskr., No. 1 (1916), pp. 1–49, figs. 24*).—This comprises a historical sketch of the forest protection laws of Sweden, together with a description of the various forestry districts and suggestions relative to the development and application of an effective forest-protection law.

Progress report of forest administration in the Jammu and Kashmir State for the year 1914–15, W. H. Lovegrove (*Rpt. Forest Admin. Jammu and Kashmir [India], 1914–15, pp. II+27+LIV*).—The usual report relative to the administration and management of the state forests in Jammu and Kashmir, including a financial statement for the year 1914–15. Data relative to alterations in forest areas, various forest operations, yields in major and minor forest products, revenues, expenditures, etc., are appended in tabular form.

Progress report of forest administration in the Punjab for the year 1914–15, R. McIntosh (*Rpt. Forest Admin. Punjab, 1914–15, pp. 3+20+LX*).—A report similar to the above relative to the administration and management of the state forests of the Punjab for the year 1914–15.

DISEASES OF PLANTS.

Miscellaneous pathological projects, H. S. Jackson and J. R. Winston (*Oregon Sta., Bien. Rpt. Hood River Sta., 1913–14, pp. 19–24*).—Preliminary reports are given on investigations of the so-called winter injury or die-back in apples, apple fruit spots and rots, mushroom root rot of apples and other trees and plants, and general observations on plant diseases.

The so-called winter injury, it is claimed, is not the result of winter conditions, but it seems probable that it has some relation with the soil and moisture conditions. All attempts to isolate an organism have given negative results, and it is thought that an improvement in the mechanical and water-holding

capacity of the soil, together with a uniform supply of moisture throughout the year, will prevent the injury.

Under the heading of apple fruit spots and rots, the authors describe bitter pit or dry rot, with which no organism has been definitely associated, Jonathan fruit spot which is said to be a serious disease of the Spitzenberg and other varieties, pink spot of Newtown apples, the cause of which has not been definitely established, and apple-tree anthracnose as a fruit rot. In this case the fungus has been definitely isolated and found to cause both forms of disease.

The mushroom root rot of apples and other trees is said to be quite serious in parts of the Hood River Valley, attacking many varieties of orchard trees and shrubs as well as garden plants. Satisfactory methods of control apparently consist of thorough aeration of the soil about the trees.

Contribution to the study of the parasitic fungi of Colombia, H. and P. SYDOW (*In Voyage d'Exploration Scientifique en Colombie. Neuchâtel: Mem. Soc. Neuchâtel. Sci. Nat., 1914, pp. 432–441, fig. 1*).—This list contains the fungi collected by Mayor exclusive of the Uredineæ as noted on page 245. Of the 42 species listed, 11 are described as new. One of these is considered to represent a new genus and has received the name *Melanochlamys leucoptera.*

Parasites of cultivated plants in Argentina, L. HAUMAN-MERCK (*Centbl. Bakt.* [*etc.*], *2. Abt., 43* (*1915*), *No. 14–16, pp. 420–454*).—Besides a discussion of diseases more or less important in Argentina, lists are given of local or more extended causes of injury or diseases of plants, including bacteria, fungi, algæ, phanerogamic parasites, and Cuscuta; also lists of such enemies attacking plants according to their groupings as garden, forage, ornamental, industrial, orchard, and forest plants. A bibliography is appended.

Report of the Institute for Phytopathology in Wageningen in 1913, J. RITZEMA BOS (*Meded. Rijks Hoogere Land, Tuin en Boschbouwsch.* [*Wageningen*], *8* (*1915*), *No. 5, pp. 249–338*).—This report deals systematically in some detail with phases of loss in plant industry due to causes of inorganic, parasitic, physiological, or unknown character.

Report on injuries and diseases of cultivated plants in the Rhine Province in 1913, E. SCHAFFNIT and G. LÜSTNER (*Veröffentl. Landw. Kammer Rheinprov., No. 3* (*1915*), *pp. 69*).—This contains reports from Bonn-Poppelsdorf and Geisenheim separately, including, besides sections on the weather and unfavorable agencies nonparasitic in character, accounts of injury or losses due to animals or to cryptogamic parasites attacking economic plants as systematically discussed by classes.

Diseases and enemies of cultivated plants in the Dutch East Indies in 1914, A. A. L. RUTGERS (*Dept. Landb., Nijv. en Handel* [*Dutch East Indies*], *Meded. Lab. Plantenziekten, No. 15* (*1915*), *pp. 45*).—This discussion, besides dealing with insect pests of agricultural plants, mentions as appearing here in 1914 for the first time rice smut (*Tilletia horrida*), *Pestalozzia palmarum* on Hevea trunks, and a Diplodia attacking the roots of Hevea stumps. Under the names of the various hosts, reports are given regarding diseases affecting a considerable number of agricultural and other plants.

Injury from smoke, late frost, frost drying, and their diagnosis, F. W. NEGER (*Tharand. Forstl. Jahrb., 66* (*1915*), *No. 3, pp. 195–212, fig. 1*).—This is an account of observations and experiments regarding leaf injury or loss as related to such factors as light, heat, darkness, fungi, sulphur dioxid, hydrochloric acid, and mechanical injuries.

The occurrence of sulphur dioxid injury to plants in the Selby smoke zone, W. W. JONES (*U. S. Dept. Int., Bur. Mines Bul. 98* (*1915*), *pp. 398–427, pls. 5*).—This report deals mainly with the occurrence of sulphur dioxid injury and of

common fungus diseases, also with such matters as the presence of insect pests, the nature of the soil, and local control methods and practices. Conditions are detailed as said to exist on a number of farms.

Conditions of plant life in the Selby smoke zone, January 1 to July 1, 1914, J. W. BLANKINSHIP (*U. S. Dept. Int., Bur. Mines Bul. 98 (1915), pp. 381–397, pls. 4, fig. 1*).—It is stated that as a rule three kinds of injury to plants may be produced by emanations from smelters, namely, flue dust injury, due to the absorption of poisons from the soil by the roots; acid spot injury to stems, foliage, and fruit, caused by drops of sulphuric acid, usually condensed about small particles of flue dust; and sulphur dioxid injury to foliage, or more rarely to stems or floral parts, due to absorption through the respiratory system, or in some instances through the epidermal cells. The conditions for the sulphur dioxid injury, the form most usual in this connection, are more favorable in moist than in dry weather.

The parasitism of seeds and its importance in general biology, V. GALIPPE (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 5, pp. 112–119*).—In this report, with which some discussion is also given, it is claimed that the study of a number of flowers has shown the presence of parasites in the anther, pollen, and stigma, also in the style and ovary, of a considerable proportion of those examined. It is thought that the facts as noted may bear a relation to anomalies of germination percentages and of other kinds.

Crown gall studies showing changes in plant structures due to a changed stimulus, E. F. SMITH (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 4, pp. 179–182, pls. 6*).—A preliminary account is given of recent experiments with crown gall in which the author describes the effect of inoculation into the cambium, the fundamental tissue of young stems, the leaf axils of growing plants, and into leaf tissue.

As a result of his investigations the author is led to the conclusion that the immature cell, wherever it is located, carries the inheritance of the whole organism, and that what it will finally become, as it matures, is dependent upon the stimuli withheld from it or applied to it. In other words, the stimulus may be either physiological, resulting in a normal structure, or pathological, resulting in an embryonic teratoma, as when a tumor-producing schizomycete is introduced into sensitive growing tissues.

Horsehair blights, T. PETCH (*Ann. Roy. Bot. Gard. Peradeniya, 6 (1915), No. 1, pp. 43–68, pls. 6*).—Discussion is given of the characters and habits of *Marasmius equicrinis*, growing only on dead tissues; *M. obscuratus*, apparently also saprophytic; a new species described as *M. coronatus*, not known to be parasitic; and some undetermined species. A fungus which has been considered provisionally as a fructification of an undetermined horsehair blight is described as *Xylaria vagans* n. sp.

The effect of the host on the morphology of certain species of Gymnosporangium, B. O. DODGE (*Bul. Torrey Bot. Club, 42 (1915), No. 9, pp. 519–542, pls. 2*).—The author has begun a study of the relation of the particular host to specific differences in the parasite in case of species of Gymnosporangium, some results from which are tabulated and discussed.

It is considered as possible that *G. fraternum* and *G. biseptatum* may be two distinct species which happen to have æcidia much alike on Amelanchier. The determination of the infection limits of these two species so far as it has been accomplished has raised the questions whether *G. fraternum* on Amelanchier goes back to the cedar as *G. fraternum*, or as *G. biseptatum*, or as both, and whether *G. biseptatum* on Amelanchier goes back to the cedar and reappears as *G. biseptatum*, or as *G. fraternum*, or as both of these forms.

Contribution to the study of the Urediueæ of Colombia, E. Mayor (*In Voyage d'Exploration Scientifique en Colombie. Neuchâtel: Mem. Soc. Neuchâtel. Sci. Nat., 1914, pp. 442–599, figs. 105*).—The author lists as having been found in Colombia 158 species belonging to the Uredineæ which are included in 13 genera. Of the 83 species described as new, one is considered to represent a new genus, which has received the name *Chrysocelis lupini*.

Diseases of grains and forage crops, M. T. Cook and J. P. Helyar (*New Jersey Stas. Circ. 51 (1915), pp. 3–8*).—Descriptions are given of the principal diseases of oats, wheat, corn, barley, alfalfa, and clover, with suggestions for their control.

Control of Fusarium, I. Weidner (*Illus. Landw. Ztg., 35 (1915), No. 53, pp. 351, 352, figs. 4*).—Describing experiments testing some fungicides for control of Fusarium on cereals, the author states that the preparations Fusariol and Sublimoform, as furnished by the Munich Agricultural and Botanic Institute, are found to be remarkably simple, effective, and inexpensive means for control of this fungus on grain intended for seed.

Experiments in control of club root of crucifers, A. Naumann (*Flora, K. Sächs. Gesell. Bot. u. Gartenbau Dresden, Sitzber. u. Abhandl., n. ser., 17 (1912–13), pp. 62–78, pl. 1, figs. 3*).—An account is given of tests from which good results as regards control of *Plasmodiophora brassicæ* were obtained by the employment of a patented preparation. The favorable effects are attributed to the large proportion of lime and the loosening and aeration of the soil due to the addition of mold, without which the good effects of the lime appeared to have been considerably lessened.

Combined fungus attacks on some root crops, J. Eriksson (*Ztschr. Pflanzenkrank., 25 (1915), No. 2, pp. 65–71, figs. 5*).—The author gives an account of the simultaneous occurrence on kohl-rabi of *Fusarium brassicæ* and *Pseudomonas campestris*, also on beets of *F. betæ* and *Phoma betæ*.

Crown gall of alfalfa, J. Ritzema Bos (*Tijdschr. Plantenziekten, 20 (1914), No. 4, pp. 107–114, fig. 1*).—This is a discussion of the earlier appearances of *Urophlyctis alfalfæ* in different countries, the systematic relations and biology of the fungus, and measures for protection against it, including the destruction of affected plants and soil drainage.

Common diseases of beans, M. T. Cook (*New Jersey Stas. Circ. 50 (1915), pp. 2–4*).—Descriptions are given of the more common diseases known to attack the bean together with suggestions for their control.

Yellowing of beets by disease, J. Vasters (*Landw. Ztschr. Rheinprov., 16 (1915), No. 42, pp. 641, 642*).—It is stated that over large areas of the Rhine Province both ordinary and sugar beets showed this year premature yellowing of the leaves which was particularly noticeable in certain sections named. Besides animal parasites which had visibly injured the plants in some instances, examination showed the presence of mycelium or spores of *Uromyces betæ*, *Sporidesmium* (*Clasterosporium*) *putrefaciens*, *Cercospora beticola*, and spores of two fungi, possibly *Phyllosticta betæ* and *P. tabifica*. The plants suffered more or less premature loss of foliage with corresponding decrease of product. The possible bearing of rotation, manuring, and more directly protective measures is discussed.

A bacterial disease of cassava, G. Bondar (*Bol. Agr. [São Paulo], 16. ser., No. 6 (1915), pp. 513–524, figs. 4*).—A description is given of a serious stem disease of *Manihot palmata*, ascribed to *Bacillus manihotis*, which causes a form of subcortical gummosis, wilting, and, in case of young plants, death in the majority of cases. The disease, it is thought, may be transmitted by insects, also by tools. Of the three varieties of *M. palmata* discussed, one shows considerable resistance while another is very susceptible.

No curative treatment is known. Preventive measures include the use of stock and soil known to be free from the disease, selection of resistant varieties, control of insect parasites, and care in cultural operations to prevent injury to the plants and transference of the organism.

Leaf scorch, scab, and gray mildew of cucumbers, O. Appel (*Deut. Landw. Presse, 42 (1915), No. 85, pp. 728, 729, pl. 1*).—This contains descriptions of the respective effects on cucumber of *Corynespora melonis*, *Cladosporium cucumerinum*, and *Botrytis cinerea*, with some discussion of conditions and means of their communication. Control measures include the employment of only sound seed with good cultural conditions, and destruction of diseased plants.

Control of Corynespora, the cause of leaf scorch of cucumbers, Oberstein (*Illus. Schles. Monatschr. Obst, Gemüse u. Gartenbau, 4 (1915), No. 4, pp. 41–43, figs. 2*).—The author presents some information collected regarding the history, effects, and control of the Corynespora disease of cucumbers, the control measures including the avoidance of suspected soil, seed, or plant rubbish, and disinfection of the seed bed with formalin.

A physiological study of certain strains of Fusarium oxysporum and F. trichothecioides in their causal relation to tuber rot and wilt of Solanum tuberosum, G. K. K. Link (*Abs. in Science, n. ser., 43 (1916), No. 1105, p. 328*).—The author states that certain strains of these two species of Fusarium have produced both tuber rot and wilt of the Irish potato. Wilt is induced by destruction of the root system and by clogging of the xylem elements in the stem, and is, in mild cases, marked by such symptoms as discoloration of the leaves, curling and rolling of the leaves, and production of aerial tubers. Under field and storage conditions, *F. oxysporum* is said to be probably more responsible for wilt than *F. trichothecioides*, while the latter species is more responsible for tuber rotting. The optimum and maximum temperatures of *F. oxysporum* are higher than those of *F. trichothecioides*. On the other hand, *F. trichothecioides* grows well at temperatures of 8 to 10° C. (46.4 to 50° F.), while the other species does not. *F. oxysporum* is considered more cosmopolitan, and it can utilize materials more readily than, but not so completely as, does *F. trichothecioides*.

Effect of certain species of Fusarium on the composition of the potato tuber, L. A. Hawkins (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 5, pp. 183–196*).—A report is given of an investigation made to determine the effect of *F. oxysporum* and *F. radicola* on the sucrose, reducing sugar, starch, pentosan, galactan, and crude fiber content of the potato.

It was found that these fungi reduced the content of sugar, both sucrose and reducing sugar, pentosans, galactans, and dry matter. The starch and methyl pentosans were apparently not affected appreciably and the crude fiber content was not reduced. It was found that these two species of fungi secrete sucrose, maltase, xylanase, and diastase, the last-mentioned enzym apparently being incapable of acting on the ungelatinized potato starch.

Late blight of potato, G. P. Darnell-Smith and E. Mackinnon (*Agr. Gaz. N. S. Wales, 26 (1915), No. 8, pp. 673–678, pls. 2*).—Late blight (*Phytophthora infestans*), which became serious in New South Wales in 1909 and widespread in 1910, is said to have been considerably decreased by the dry conditions prevalent in Australia for some years past. The development of the fungus and the progress of the disease are described.

Experimental culture work is said to have shown that the fungus thrives best at 60 to 70° F., no conidia forming at temperatures above 77°, and no further growth of mycelium taking place above 88°. The conidia germinate

readily between 50 and 77°, infecting either the leaves or the tubers. Experiments are said to have shown that the loss through tuber infection is decreased if the digging is postponed for a week or more after the dying of the tops, except in very wet weather and on low, heavy soil, which conditions require early digging. Infected tubers, though capable of spreading the disease, show little or no change, the wet rots sometimes observed being due to the entrance of other organisms.

Control measures include the use of blight-free seed, complete removal of material from the previous crop, rotation, spraying (which is regarded as protective only), and the use of resistant stock. The variety New Era is said to have yielded excellent results since its appearance several years ago.

Biochemical studies on potato leaf roll disease.—V, The amylase of tubers from plants showing leaf roll, G. DOBY and J. BODNÁR (*Ztschr. Pflanzenkrank., 25 (1915), No. 1, pp. 4–16*).—The work previously reported on by one of the authors (E. S. R., 28, p. 150) has been extended to a study of the amylase of tubers.

It is thought that the amylase of potatoes is present partly as zymogen, which passes over continually into the active state. The activity in freshly expressed sap showed no relation to the variety or origin of the potatoes tested. In general, sound tubers possess more zymogen than diseased ones.

These studies are not considered as having yet demonstrated a basal chemical criterion for the presence of leaf roll, or as having decided whether the chemical or biochemical changes observed in diseased tubers are the cause or the effect of the disease, or how far the optimum and the activities of amylase differ in sound and in diseased tubers.

Rice smut, A. A. L. RUTGERS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 11 (1914), pp. 7, figs. 2*).—A description, with bibliography, is given of the grain smut of rice and of the causal fungus (*Tilletia horrida*), which is considered identical with *T. corona*.

A new brown spot disease of the leaf of Glycine hispida caused by Septoria glycines n. sp., T. HEMMI (*Trans. Sapporo Nat. Hist. Soc., 6 (1915), No. 1, pp. 12–17*).—The author describes a disease of *G. hispida* characterized by enlarging spots appearing on both surfaces of young leaves, which become discolored and fall, the disease working toward the top of the plants and often ruining the entire crop. The disease, which is due to a fungus described as *S. glycines* n. sp., spreads most rapidly in damp, warm weather and in places which are incompletely drained. In a dry season or place the disease is checked, so that the upper leaves are usually not attacked, but, if the favorable conditions set up, the disease spreads again actively.

The newly described fungus is compared as regards important characters with *S. sojina*, which is said to be the only species previously noted as parasitic on the leaves of soy bean.

Injuries and diseases of tobacco in Dalmatia and Galicia in 1911, 1912, and 1913, PREISSECKER (*Fachl. Mitt. Österr. Tabakregie, 15 (1915), No. 1–3, pp. 59–64, fig. 1*).—In two sections dealing separately with Dalmatia and Galicia as regards the causation, during this period, of losses to the tobacco interests, notes condensed from official reports are given on plant and animal pests, injuries due to weather, abnormalities of physiological or unknown causation, and diseases caused by fungi in various localities.

The endoconidia of Thielavia basicola, W. B. BRIERLEY (*Ann. Bot. [London], 29 (1915), No. 116, pp. 483–493, pl. 1, fig. 1*).—The author gives an account of his study of the conidial characters and behavior in *T. basicola* which are thought to be typical of those in all fungi producing endoconidia.

The first conidium differentiates an inner wall and a sheath which ruptures near its apex, freeing the conidium. Each of the later conidia grow and push out through the empty sheath of the first, being freed from the next below by the splitting of the basal wall which is formed between the two cells by the ingrowth of a basal ring which finally closes in the center.

A bibliography is appended.

Watermelon stem-end rot, F. C. Meier (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 4, pp. 149–152, pl. 1*).—A preliminary report is given of investigations made to determine the cause of a decay of watermelons that has been frequently noted in shipments of those fruits. Material was secured from a shipment received in this city in July, 1915, and an examination showed that more or less injury had occurred in a very uniform manner. In the early stages the presence of decay was indicated by a watery discoloration of the rind in an area closely surrounding and apparently extending from the stem. From this all stages of decay were noted until half or more of the melon was involved. In the later stages the rind portion becomes soft and wrinkled and the flesh below is slimy and blackened.

From the material secured a fungus belonging to the genus Diplodia was isolated and inoculation experiments produced typical decay. The specific identity of the fungus has not been determined but inoculations made from a culture of *D. tubericola* produced a decay that took the same course as that described above. Species of Diplodia are known to attack a number of economic plants, and the relation of some of these to the watermelon, it is thought, might possibly show whether a species found on one host would grow equally well upon another.

Brown rot of fruit, D. M. Cayley (*Gard. Chron., 3. ser., 58 (1915), No. 1505, pp. 269, 270, figs. 2*).—It is stated that the wet weather of 1915 was probably the cause of the prevalence of *Sclerotinia* (*Monilia*) *fructigena*, causing brown rot of apple and pear. This form is discussed in connection with the closely related forms *S. cinerea* on stone fruits and *S. laxa* on apricots. The mycelium of *S. fructigena* is said to persist in the twigs, branches, spurs, and mummied fruits during the winter and to produce conidia by the time the apple and pear blossoms open. It is said that the fungus may be spread by contact of injured with sound fruits in handling, as the fungus is a wound parasite developing rapidly from very minute injuries.

A Bordeaux spray in early spring before the blossoms open is recommended. Affected parts should be removed and burned during the winter, and rotten apples should be carefully removed in summer.

Experiments for control of apple scab, H. S. Jackson and J. R. Winston (*Oregon Sta., Bien. Rpt. Hood River Sta., 1913–14, pp. 6–18, figs. 7*).—Results are given of experiments conducted in the Hood River Valley for the control of apple scab, in which lime-sulphur, atomic sulphur, soluble sulphur, and Bordeaux mixture were used separately or in combination with other materials.

As a result of one season's work, the most important application for the prevention of scab proved to be the delayed dormant spray of lime-sulphur and Black Leaf 40. Lime-sulphur was found the most efficient preventive of any one mixture used. Severe fruit injury was often found to follow summer application of lime-sulphur when made just previous to extremely hot weather. It is said that neither atomic nor soluble sulphur can be recommended as a remedy for scab when used in all applications, but good results followed the application of atomic sulphur in the calyx and subsequent applications where lime-sulphur had been used in the first application. No appreciable fruit or foliage injury was observed where this method was followed.

The use of lime-sulphur as a summer spray for apple scab, C. C. VINCENT (*Idaho Sta. Bul. 85 (1916), pp. 16, figs. 5*).—The results are given of three years' experiments in the use of lime-sulphur as a summer spray for apple scab. The experiments were carried out on the college orchard to ascertain the value of lime-sulphur as a summer spray for scab and to determine the number of applications needed to hold the disease in check. As a result of the work, it is claimed that lime-sulphur is an effective remedy for the control of apple scab, good results being secured during wet as well as dry seasons. The cost of three applications was 8.1 cts. per tree.

In the course of the investigation it was found that different varieties varied in resistance to the disease. Grimes Golden is said to be quite resistant, and one application made at the time the buds were showing pink reduced the fungus attack to a negligible quantity. On the other hand, Wagener, Rome, and Jonathan were subject to attack and neither one nor two applications were sufficient to check the disease completely.

In addition to spraying, the author recommends pruning, cultivation, and fertilization.

The common diseases of the pear, G. W. MARTIN (*New Jersey Stas. Circ. 52 (1915), pp. 3–12, figs. 6*).—The author describes the more common diseases of the pear and gives suggestions for their control. A spray calendar is given, in which time of application, fungicide or insecticide, and the principal causes of injury are indicated.

Apricot disease in the Rhone Valley, P. CHIFFLOT and MASONNAT (*Compt. Rend. Acad. Agr. France, 1 (1915), No. 15, pp. 473–477*).—The report of this outbreak has already been noted (E. S. R., 35, p. 50). *Monilia cinerea* and *M. laxa* have both been claimed to cause the disease.

Brown rot of prunes and cherries in the Pacific Northwest, C. BROOKS and D. F. FISHER (*U. S. Dept. Agr. Bul. 368 (1916), pp. 10, pls. 3*).—The authors report upon an investigation of blossom infection and fruit rot of prunes and cherries, both of which diseases are said to have become quite destructive in parts of Oregon and Washington. The investigation indicates that the trouble is due to *Sclerotinia cinerea*, and spraying experiments have shown the practicability of materially reducing loss from this fungus. The blossom blight was found to be an important factor in the poor set of prune fruit in 1915, and the occurrence of the brown rot on the fruit destroyed a large amount in transit and storage.

As a result of the work with prunes, it was found that both self-boiled lime sulphur and Bordeaux mixture, when properly applied, give satisfactory control. Four applications are recommended, the first just before the blossoms open, the second after the petals have fallen, the third three or four weeks later, with a fourth about four weeks before harvesting.

Blossom infection and fruit rot of cherries due to the same cause have been investigated, and while work with cherries has not been carried out so fully as with prunes, it is thought that a treatment similar to that given for prunes would satisfactorily control the diseases.

Perocid for Peronospora on grapevines, F. GVOZDENOVIC (*Staz. Sper. Agr. Ital., 48 (1915), No. 3, pp. 153–174*).—Perocid, three forms of which are prepared as chemical by-products, is said to have shown a considerable degree of efficiency for the control of grape downy mildew.

Citrus bark rot, G. H. ZERBST (*Philippine Agr. Rev. [English Ed.], 8 (1915), No. 2, pp. 95–97*).—It is stated that since 1911 citrus culture has suffered severely from a bark rot occurring over practically the entire province of

Batangas. The mandarin (*C. nobilis*) appears to be extremely sensitive, the calamondin (*C. mitis*) being less severely injured, and the sweet orange (*C. aurantium*) and the pomelo (*C. decumana*) being seldom affected to a serious degree.

The disease and its results are described. It is supposed to be produced by unfavorable soil and culture conditions, one of the main factors being the packing of the soil, which prevents aeration and drainage. Irregularity of water supply appears to be another factor. Recommendations include proper plowing, varying in depth each year, planting in the rainy season to cover crops, which should be cut and left as a mulch during the dry season, removal of diseased spots, and covering the wounds with lead paint.

Some abnormalities of the coconut palm, T. PETCH (*Ann. Roy. Bot. Gard. Peradeniya, 6 (1915), No. 1, pp. 21–30*).—The author gives an account of abnormalities which he has noted during the last few years, including yellow coconuts, double coconuts, prolification, and hypertrophy of the perianth.

The effect of lightning on coconut palms, T. PETCH (*Ann. Roy. Bot. Gard. Peradeniya, 6 (1915), No. 1, pp. 31–42*).—The author gives collected accounts and his own observations of injuries to coconut palms by lightning in tropical and subtropical regions. The visible effects discussed are combustion of the crown, mechanical injury, and exudation of the gum, often with little or no indication of mechanical injury. The last is thought to be sometimes connected in some way with the heat generated by the electrical discharge.

Black canker of chestnut, L. PETRI (*Alpe [Italy], 2. ser., 2 (1915), Nos. 3, pp. 94–99, pl. 1; 5, pp. 188–196, figs. 3*).—Discussing the findings and views of others regarding the factors which produce or favor black canker of chestnut, the author describes the phenomena observable in the origin and development of the abnormal conditions associated with the presence of several fungi. He distinguishes between the rapid and quickly fatal attack usual to Coryneum and the progress and behavior of the other fungi which commonly precede it as regards the original attack and in some cases possibly furnish the conditions for its rapidly destructive phase. It is stated that frost injuries apparently favor Coryneum attack, which, in this case, may be of limited extent.

From a study of the questions whether black rot of the roots precedes or follows the infection of the branches and stem and whether Coryneum is able to attack directly the roots and base of the trunk, the author has concluded that, in case of plants just beginning to show disease, the base of the trunk and contiguous portions of the larger roots may be found to show the alterations associated with black rot before Coryneum can be demonstrated in the upper portions. The infection of the base of the stem by Coryneum may be noted in nursery stock or in chestnuts used as replants where older plants have died with black rot. The initially basal attack by Coryneum appears to be limited by the age of the plant. It is said that it may be difficult in an advanced stage of the disease to establish the order of precedence of the two infections, that of Coryneum proceeding from above downward and that of other fungi proceeding upward.

The influence of the tannin content of the host plant on Endothia parasitica and related species, M. T. COOK and G. W. WILSON (*Bot. Gaz., 60 (1915), No. 5, pp. 346–361*).—This is a more extended report on investigations the main results of which have been noted from another source (E. S. R., 32, p. 646).

The influence of ether on the growth of Endothia, M. T. COOK and G. W. WILSON (*Bot. Gaz., 60 (1915), No. 5, pp. 412, 413*).—The authors, giving results of some studies in connection with those noted above, state that while small quantities of ether in liquid culture media appear to have a stimulating effect

on *E. parasitica*, the use of proportions from 0.2 per cent up retards germination, and the use of those from 0.4 per cent upward results injuriously to the growth of the fungus.

Diseases and injuries of Hevea brasiliensis in Java, A. A. L. RUTGERS and K. W. DAMMERMAN (*Dept. Landb., Nijv. en Handel* [*Dutch East Indies*], *Meded. Lab. Plantenziekten, No. 10* (*1914*), *pp. 45, pls. 12, fig. 1*).—This is a somewhat systematic discussion of local insect enemies, diseases, and abnormalities of *H. brasiliensis* classified according to portion of the plant attacked, with references under the several sections to related literature. Parasitic fungi named in connection with diseases include, on the roots, *Fomes semitostus*, *Hymenochæte noxia*, and *Sphærostilbe repens;* on the branches, *Corticium salmonicolor* (*C. javanicum*), *Thyridaria tarda*, *Glœosporium alborubrum*, and *Phyllosticta ramicola;* on the trunk, *Phytophthora faberi;* and on the leaves, *Phyllosticta heveæ* and *Pestalozzia palmarum.* Injurious changes in the latex and prepared rubber are discussed, also such abnormalities as excrescences and fasciations.

The pseudosclerotia of Lentinus similis and L. infundibuliformis, T. PETCH (*Ann. Roy. Bot. Gard. Peradeniya, 6* (*1915*), *No. 1, pp. 1–18, pl. 1*).—Reviewing related contributions and describing a study of sclerotia in Lentinus found on stumps of *Hevea brasiliensis*, the author states that in addition to species possessing a true sclerotium, there appear to exist others whose mycelium merely binds together the earth in a large compact mass, while *L. similis* and *L. infundibuliformis* exhibit a third type in which the skeleton of the pseudosclerotium consists of the wood of the host plant. It is considered as still an open question whether these types are definitely associated with different species of Lentinus or are merely stages which may be assumed by the sclerotium in any given species.

Leaf-spot disease of lime, E. S. SALMON and H. WORMALD (*Gard. Chron., 3. ser., 58* (*1915*), *No. 1500, pp. 193, 194, figs. 2*).—It is stated that a leaf and shoot disease of lime or linden trees near Maidstone in Kent has been identified as *Glœosporium tiliæcolum*, reported on the Continent by Laubert in 1904 (E. S. R., 16, p. 988), but not previously recorded in England. The disease and the habits of the fungus are described.

Infection studies with Melampsora on Japanese willows, T. MATSUMOTO (*Trans. Sapporo Nat. Hist. Soc., 6* (*1915*), *No. 1, pp. 22–37, figs. 5*).—Giving an account of morphological, systematic, and infection studies, regarded as being of a preliminary character, on several species of Melampsora, the author expresses his belief that a connection exists between the Melampsora on *Populus* spp. and the cæoma spores on *Chelidonium majus*, although this could not be definitely settled with the material obtained. It is thought probable that a disease of *Salix caprea* in Japan may be due to the rust fungus which has been designated as *M. larici-capræarum.*

Technical descriptions are given of the new species *M. yezoensis* on *S. jessoensis* (cæoma stage on *Corydalis ambigua*), *M. larici-miyabeana* on *S. miyabeana* (cæoma on *Larix europæa* and *L. leptolepis*), and *M. larici-opaca* on *S. opaca* (cæoma on *L. europæa* and *L. leptolepis*).

The recent outbreaks of white pine blister rust, P. SPAULDING (*Jour. Wash. Acad. Sci., 6* (*1916*), *No. 4, pp. 102, 103*).—Giving a brief account of white pine blister rust in this country, the author states that in the years 1909 to 1914 there were 11 outbreaks of the disease; that is, cases where it escaped from diseased pines and attacked currant or gooseberry. Owing to favorable weather conditions during 1915, it spread very readily and for relatively long distances. Twelve outbreaks were noted, the extent of attack varying from a few bushes to a single area of from 400 to 500 square miles. It is stated that all of the

species of currant and gooseberry tested thus far have been found to be susceptible, the widely distributed black currant (*Ribes nigrum*) being especially so.

Discussion on decay in timber (*Trans. Canad. Soc. Civ. Engin., 29 (1915), pt. 1, pp. 324–365, figs. 29*).—This discussion, participated in by a number of engineers, deals with the conditions, forms, and results of attacks on various woods, as in mill and other structural timbers, by fungi, more particularly by *Merulius lacrymans*, *Coniophora cerebella*, and *Trametes serialis*, as well as other fungi not yet identified.

Among the more resistant woods heart pine stands very high, as does also wood containing tannin in relation with Merulius. Moisture which may condense following a fall in temperature greatly favors attacks in many cases. Air driven from near the surface of warm, moist earth may become saturated and give up moisture in a cooler underground space, wetting the wood instead of drying it. A water pipe may cool surrounding air to saturation and rot adjacent timbers. Certain materials absorb water at high temperatures and give it up at lower temperatures. Hygroscopic salts may form in certain situations or processes. It is thought that *M. lacrymans* may obtain the moisture and oxygen it requires from the wood it decomposes.

A bibliography is appended.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A history of British mammals, G. E. H. BARRETT-HAMILTON and M. A. C. HINTON (*London: Gurney & Jackson, 1915, [vol. 2], pt. 17, pp. 503–552, pls. 2, figs. 4*).—A continuation of the Muridæ of the Rodentia, previously noted (E. S. R., 34, p. 57) in which descriptions of the field mouse, the Hebridean field mouse, the St. Kilda field mouse, the Fair Isle field mouse, the yellow-necked field mouse, and De Winton's field mouse of the genus Apodemus are given, and a description of the genus Micromys commenced.

Some observations on the rate of digestion in different groups of wild birds, W. E. COLLINGE (*Jour. Econ. Biol., 10 (1915), No. 3, pp. 65–68*).—Experiments tabulated show that the rate of digestion differs in the rook from that in the English sparrow, and that these two birds and the starling digest the stomach contents in a period of from 4 to 4.5 hours.

A synopsis of the races of the long-tailed goat-sucker, Caprimulgus macrurus, H. C. OBERHOLSER (*Proc. U. S. Nat. Mus., 48 (1915), pp. 587–599*).

A review of the subspecies of the ruddy kingfisher, Entomothera coromanda, H. C. OBERHOLSER (*Proc. U. S. Nat. Mus., 48 (1915), pp. 639–657*).

Entomological investigations, H. F. WILSON and L. CHILDS (*Oregon Sta., Bien. Rpt. Hood River Sta., 1913–14, pp. 40–50*).—In studies made of the insects of the Hood River Valley, the codling moth was found to be the most important pest. Observations of this insect made during the period under report indicate the occurrence of a third brood. It is said that during the last two or three weeks prior to harvesting, a large number of young larvæ appeared and entered the fruit, causing considerable damage, and that the damage was serious, even in orchards where three spray applications had been previously made.

Statistical data relating to codling moth work in twelve orchards are presented in tabular form for several varieties of apple, showing the extent of damage to the fruit, with various spraying dates, strengths, and combinations of brands. Arsenate of lead in combination with blackleaf 40, lime-sulphur, and Bordeaux mixture gave very efficient results.

Observations relative to seasonal history and habits are included. The adults emerge in May and commence to oviposit as soon as the evening temperature rises to 60° F. or above, which condition prevails about June 1. The earliest

larvæ in the spring reach maturity about July 7 to 10, from which time mature larvæ and pupæ can be found until the latter part of July. By August 1 the eggs of the second generation begin to appear, and by August 10 the young larvæ are entering the fruit quite freely. Larvæ and pupæ were found in October, which, it is thought, may have been the third generation of moths, above mentioned, or possibly stragglers from the second generation. Brief reference is made to the control of the codling moth by the two forms of arsenate of lead, a report upon which has been previously noted (E. S. R., 34, p. 548). The second spray should be made at the time the eggs are hatching and the first brood of larvæ are entering the fruit, probably three or four weeks after the calyx or first spray, or about the first or second week in June. The third application, usually given to check the larvæ of the second brood, should be made about six weeks after the second, or from July 25 to August 5. Where a fourth spray is thought desirable for late-appearing larvæ, it should be applied about September 1.

Data relating to a number of minor pests follow. Those thus mentioned are the brown mite, which feeds primarily on clover, alfalfa, and peas, but also occurs on fruit trees and in some instances causes considerable injury; the climbing or variegated cutworm which bores into the fruit; the fruit-tree leaf-roller, which, though present in the Hood River Valley for a number of years, has only been a source of damage during the past two or three years; the brown apple aphis which has been the source of considerable loss through its injury to the fruit; the woolly apple aphis and the green apple aphis; the pear slug; the San José scale and oyster shell scale; the peach and prune twig miner; and the apple leaf miner.

Proceedings of the Entomological Society of British Columbia, 1915 (*Proc. Ent. Soc. Brit. Columbia, n. ser., No. 7 (1915), pp. 48*).—The first part (pp. 5–21) of this report presents the proceedings of the second midsummer meeting of 1914, the second part (pp. 22–45) those of 1915, in continuation of the report previously noted (E. S. R., 34, p. 651).

The following are the more important papers presented: Insect Notes from the Okanogan in 1914, by M. Ruhman (pp. 7–11); The Control of Incipient Infestation of Codling Moth in a New District, by W. H. Lyne (pp. 11–13); Sprays of Up-To-Date Interest, by L. L. Palmer (pp. 14–16); The Tarnished Plant Bug (*Lygus pratensis*), by R. C. Treherne (pp. 16–18); The Part Played by Insects in the Spread of Plant Diseases, by J. W. Eastham (pp. 18–21); Insect Pests in Greenhouses, by G. E. Wilkerson (pp. 25–30); Notes on Some Insects of the Lower Fraser Valley, by F. H. Getchell (pp. 30–33); Comments on Some Peculiarities in Connection with the Life History of the Codling Moth on the Pacific Coast, by W. H. Lyne (pp. 33–35); Shade Tree and Ornamental Insects of British Columbia, by R. C. Treherne (pp. 35–41); The Outbreak of Locusts of 1914, by T. Wilson (pp. 41–43); Notes on Birds Likely to be of Service in the Destruction of Grasshoppers in the Nicola Valley, by L. E. Taylor (pp. 43–45); and The Kansas Remedy for the Control of Locusts, by A. Gibson (p. 45).

[Economic entomology] (*Ztschr. Angew. Ent., 2 (1915), No. 1, pp. 264, figs. 119*).—The several papers here presented deal with The Potato Fleabeetle (*Psylliodes affinis*), of which the morphology and biology of the immature stages are considered by F. Tölg (pp. 1–9) and the morphology and bionomics of the adult, by F. Heikertinger (pp. 10–28); Flacherie of the Mediterranean Flour Moth (*Ephestia kühniella*) and the Causative Agent, *Bacillus thuringiensis* n. sp., by E. Berliner (pp. 29–56); Biology of the Tachinids *Parasetigena segregata* and *Panzeria rudis*, by H. Prell (pp. 57–148); Artificial Infestation of the Vine Caterpillars (*Cochylis ambiguella* and *Polychrosis botrana*) by

Parasitic Insects, by K. H. C. Jordan (pp. 149–157); Morphological and Systematic Investigations of the Red Spider (*Tetranychus dufour*), by I. Trägårdh (pp. 158–163); and Notes on the Outbreaks of the Kieferneule (*Panolis piniperda*) in the Dresden Forest Reserve, by Neumeister (pp. 164–167).

The distribution of California insects, I, E. O. Essig (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 3, pp. 113–120, figs. 6*).—The author considers the distribution of six of the more important insects occurring in California, and presents maps which show the occurrence of each.

Observations on insect pests in Grenada, H. A. Ballou (*Bul. Ent. Research, 6 (1915), No. 2, pp. 173–181*).—The notes here presented relate to the cacao thrips (*Heliothrips rubrocinctus*), the cacao beetle (*Stirastoma depressum*), the acrobat ant (*Cremastogaster* sp.), and the control of scale insects by natural enemies.

The insects of central Europe, especially Germany, edited by C. Schröder (*Die Insekten Mitteleuropas insbesondere Deutschlands. Stuttgart: Franckh'sche Verlagshandlung, 1914, vols. 2, pp. VIII+256, pls. 5, figs. 124; 3, pp. VIII+213, pls. 8, figs. 133*).—In the second volume of this work, the first of which is not at hand, the Formicidæ are dealt with by H. Stitz (pp. 1–111) and the Ichneumonidæ, Braconidæ, Chalcididæ, etc., by O. Schmiedeknecht (pp. 113–256); and in the third the Cynipidæ by J. J. Kieffer (pp. 1–94) and the Tenthredinidæ, Cephidæ, Siricidæ, and Oryssidæ by E. Enslin (pp. 95–213). An extensive bibliography and an index to the genera and species accompany each paper. Several colored plates are included.

Manufacturing tests of cotton fumigated with hydrocyanic-acid gas, W. S. Dean (*U. S. Dept. Agr. Bul. 366 (1916), pp. 12*).—Spinning and chemical laboratory tests reported indicate that fumigation of cotton with hydrocyanic-acid gas does not affect, to any material extent, the percentages of waste, spinning qualities, tensile strength, bleaching, dyeing, or mercerizing properties of the cotton.

Contribution to the knowledge of olive insects of Eritrea and of South Africa, F. Silvestri (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Sup. Agr. Portici, 9 (1914–15), pp. 240–334, figs. 78; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 5, pp. 765–768*).—A detailed account of observations of insect enemies of *Olea chrysophylla* and *O. verrucosa* made during the course of excursions in quest of parasites of the olive fly (*Dacus oleæ*). Systematic descriptions of many species new to science are accompanied by biological notes.

Forest insects of Sweden, I. Trägårdh (*Sveriges Skogsinsekter. Stockholm: Hugo Gebers, pp. VIII+279, pls. 16, figs. 136; rev. in Canad. Ent., 47 (1915), No. 6, pp. 199, 200*).—Following preliminary chapters on the characters and organization of insects, their development, and general methods of control, the author deals with the different orders, commencing with the Coleoptera, describing those families and their members that are injurious to forests or useful as parasitic or predacious enemies of forest insects. A special chapter is devoted to gall-making insects and Eriophyes and another to control measures. The work concludes with a table giving keys to the various insects according to the trees and parts of the trees they attack.

Descriptions of a new genus and species of the discodrilid worms, M. C. Hall (*Proc. U. S. Nat. Mus., 48 (1915), pp. 187–193, figs. 3*).—*Ceratodrilus thysanosomus* collected on crayfish in the streams of Great Basin, Salt Lake City, Utah, is described as representing a new genus and species.

An anatomical note on the genus Chordeiles, A. Wetmore (*Proc. Biol. Soc. Wash., 28 (1915), pp. 175, 176, fig. 1*).

White ants in Japan, M. YANO (*Extracts from Bul. Forest Expt. Sta., Tokyo, 1915, pp. 134–142, pls. 3*).—The present paper describes three species of termites which occur in the main island, Shikoku, and Kiushu, namely, *Leucotermes (Reticulitermes) speratus, Coptotermes formosanus*, and *Calotermes (Glyptotermes) satsumensis*, including their life history, natural enemies, distribution, and the damage which they cause.

A new Trichodectes from the goat, V. L. KELLOGG and S. NAKAYAMA (*Psyche, 22 (1915), No. 2, pp. 33–35, fig. 1*).—The name *Trichodectes hermsi* is given to a species taken from a badly infested young merino goat near Inverness, Marin County, Cal.

Dendrotettix quercus, A. N. CAUDELL (*Psyche, 22 (1915), No. 2, pp. 52–54*).—Considerable damage was done by this species at New Lisbon, N. J., during the season of 1914.

The control of locusts in Italy, A. LUNARDONI (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 4, pp. 522–532, pls. 2*).—A summary of control work in Italy.

The question of the bacterial method of controlling locusts, A. V. GRATCHOV (*Zhur. Mikrobiol., No. 1–2 (1914), p. 175; abs. in Rev. Appl. Ent., Ser. A, 3 (1915), No. 11, pp. 699, 700*).—The author suggests the passing of the bacillus (*Coccobacillus acridiorum*) directly from dead insects of one series into those of another without any intermediate cultivation on agar-agar, thus eliminating the danger of losing the virus.

The biological method for the destruction of locusts, F. D'HERELLE (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 17, pp. 503–505; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 1, pp. 14, 15*).—A further report of work with *Coccobacillus acridiorum* (E. S. R., 31, p. 752), which was carried on in Tunis.

A test of Coccobacillus acridiorum d'Herelle on locusts in the Philippines, M. A. BARBER and C. R. JONES (*Philippine Jour. Sci., Sect. B, 10 (1915), No. 2, pp. 163–176*).—Experiments conducted in the Philippines with *Œdaleus nigrofasciatus* and *Locusta migratoroides* in which cultures of *C. acridiorum* from the Pasteur Institute were used gave negative results. Reports received from consuls in Argentina, Colombia, and Algeria in response to a request for information regarding the results obtained from the use of *C. acridiorum* in those countries are appended. The information given seems to indicate that thus far the use of this organism has not been practical.

Two new Thysanoptera from West Africa, with a note on the synonymy of the Phlœothripidæ, J. D. HOOD (*Psyche, 23 (1916), No. 1, pp. 6–12, pl. 1*).

A new vine thrips from Cyprus, R. S. BAGNALL (*Bul. Ent. Research, 6 (1915), No. 2, pp. 199, 200*).—A thrips which is injurious to vines in Cyprus is described as ***Cryptothrips brevicollis*** **n. sp.**

The cabbage harlequin bug or calico bug (Murgantia histrionica), W. A. THOMAS (*South Carolina Sta. Circ. 28 (1915), pp. 4, fig. 1*).—A brief account with remedial measures.

The immature stages of Tropidosteptes cardinalis, M. D. LEONARD (*Psyche, 23 (1916), No. 1, pp. 1–3, pl. 1*).—This capsid was the source of some injury to the leaves of ash at Ithaca, N. Y.

Synoptical keys to the genera of the North American Miridæ, E. P. VAN DUZEE (*Univ. Cal. Pubs., Ent., 1 (1916), No. 3, pp. 199–216*).—The keys here given cover all but eight of the genera of the hemipterous family Miridæ thus far recorded from America north of Mexico.

The immature stages of two Hemiptera, Empoasca obtusa and Lopidea robiniæ, M. D. LEONARD (*Ent. News, 27 (1916), No. 2, pp. 49–54, pls. 2*).—Technical descriptions are given of the several stages of these insects.

A psyllid gall on Juncus (Livia maculipennis), EDITH M. PATCH (*Psyche, 23 (1916), No. 1, pp. 21, 22, pl. 1*).—The author records the occurrence of *L. maculipennis* on Juncus at Magnolia Village, Mass.

A synopsis of the aphid tribe Pterocommini, H. F. WILSON (*Ann. Ent. Soc. Amer., 8 (1915), No. 4, pp. 347–358, figs. 13*).—Ten species of this tribe have been described, of which three have been recorded from Europe and five from America. All the known species commonly feed on willows and poplars, and one species is recorded as also being found on maple.

The pea aphis, A. MORDVILKO (*Trudy Bîuro Ent. [Petrograd], 8 (1915), No. 3, 2. rev. and enl. ed., pp. 54, pls. 2, figs. 4; abs. in Rev. Appl. Ent., Ser. A, 3 (1915), No. 11, pp. 702–704*).—The second revised and enlarged edition of this paper. The synonymy and a bibliography are appended.

Some intermediates in the Aphididæ, A. C. BAKER and W. F. TURNER (*Proc. Ent. Soc. Wash., 18 (1916), No. 1, pp. 10–14*).

A new genus and species of Aleyrodidæ from British Guiana, A. L. QUAINTANCE and A. C. BAKER (*Ann. Ent. Soc. Amer., 8 (1915), No. 4, pp. 369–371, figs. 18*).—*Eudialeurodicus bodkini* n. g. and n. sp., reared from leaves of *Erythrina glauca* at Berbice, is described.

The European fir trunk bark louse (Chermes [Dreyfusia] piceæ) apparently long established in the United States, J. KOTINSKY (*Proc. Ent. Soc. Wash., 18 (1916), No. 1, pp. 14–16*).—Specimens of balsam fir bark rather heavily infested with this bark louse are said to have been received from Mt. Monadnock, N. H. It is stated that the infestation has been spreading during the past three years and that a considerable number of trees have died during that time.

Reports on scale insects, J. H. COMSTOCK (*New York Cornell Sta. Bul. 372 (1916), pp. 425–603, pls. 26, figs. 15*).—This bulletin brings together the author's writings on the Coccidæ or scale insects, the first of which (pp. 425–500), entitled Reports on Scale Insects, appeared in the report of the U. S. Commissioner of Agriculture for 1880; the second (pp. 501–506), Report of the Entomologist, United States Department of Agriculture, appeared in the report of the U. S. Commissioner of Agriculture for the years 1881 and 1882; and the third (pp. 507–603), Report of the Department of Entomology, is from the second report of the Cornell Station, 1883. The pagination and the figure numbers and their sequence in the original reports have been retained.

The Coccidæ of New Jersey greenhouses, H. B. WEISS (*Psyche, 23 (1916), No. 1, pp. 22–24*).—The author lists 32 species representing 17 genera found infesting various plants in New Jersey greenhouses.

White wax coccid (Ericerus pela), M. YANO (*Extracts from Bul. Forest Expt. Sta., Tokyo, 1915, pp. 143–150, pls. 2*).—The male larvæ of this coccid secrete a white wax which is collected and known in commerce as insect wax or Chinese wax. The author gives a description of the several stages of this coccid and an account of its life history, host plants, and natural enemies, namely, *Brachytarsus niveovariegatus, Dasyneura* sp., a new chalcidid, *Chilocorus similis*, and *C. tristis*.

The oyster-shell scale and the scurfy scale, A. L. QUAINTANCE and E. R. SASSCER (*U. S. Dept. Agr., Farmers' Bul. 723 (1916), pp. 14, figs. 3*).—A revision of Bureau of Entomology Circular 121, previously noted (E. S. R., 23, p. 156).

The pink corn worm: An insect destructive to corn in the crib, F. H. CHITTENDEN (*U. S. Dept. Agr. Bul. 363 (1916), pp. 20, pls. 4, figs. 7*).—The larva of a small moth (*Batrachedra rileyi*), known as the pink corn worm, has been found in cornfields of the southern United States for nearly three-fourths of

a century, but not until 1914 was it recognized as a pest. During November and December of that year numerous complaints were made of damage to corn in cribs, especially in Mississippi. The attack begins in the field and continues after the corn has been stored. When the stored ears are husked they show injury by accumulations of webbing and frass or excrementitious matter.

"The eggs are deposited in the field where the tips of the corn ears are more or less open, due to the attack of the corn ear worm. After the latter has departed the pink corn worm continues the injury and by its work makes it easy for other insects and water to enter the ears, which eventually are ruined. From the cob or between the rows of grains the worm penetrates the kernels at the tip or point of attachment, works into the embryo or 'germ,' which it destroys, then outward to the crown.

"Unlike the Angoumois grain moth and the rice weevil, which are usually to be found working in the same fields and frequently in the same ears, this 'worm' does not confine itself to the kernel, but attacks kernel, husk, and cob alike. Also, unlike most other grain pests, it appears to be confined among cereals to corn and sorghum, although it attacks, but does not seriously injure, cotton bolls which are more or less open, and some other plants.

"While thus far it has proved most injurious in Mississippi, it ranges from South Carolina westward to central Texas, southward to tropical Texas, and northward to Arkansas and Tennessee. During the years 1914–15 the pink corn worm was reported to have occasioned very considerable injury, and much alarm was felt because of its abundance in the regions mentioned. Naturally it can not be foretold when, if ever, such an outbreak will recur.

"As a preventive of injury, corn should be left in the field no longer than is absolutely necessary for drying it; the husks should then be removed as soon as possible, the poorest of the infested ears destroyed promptly or fed to swine or poultry, and the best ears fumigated with carbon bisulphid according to the directions given. The bins or cribs should be kept scrupulously clean, and should be fumigated before new material is stored in them. Cooperation among corn growers of as large a territory as possible where the species occurs should be secured that future losses may be prevented."

A bibliography of ten titles is appended.

Notes on large scale experiments against the pink bollworm in cotton seed, G. Storey (*Agr. Jour. Egypt, 4 (1914), No. 2, pp. 115–124, pls. 2*).—These notes describe and report the results of experiments on the hot-air treatment and fumigation treatment of cotton seed for the pink bollworm (*Gelechia gossypiella*).

A note on the recent attack of Brassolis sophoræ, L. D. Cleare, Jr. (*Jour. Bd. Agr. Brit. Guiana, 8 (1915), No. 3, pp. 86, 87*).—This lepidopteran was the source of considerable injury to coconut palms at Georgetown during 1914, approximately 5 per cent of the palms having succumbed to its attack.

Studies on the vine moths, M. Topi (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. et Nat., 5. ser., 24 (1915), I, No. 5, pp. 464–468, fig. 1; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 6, pp. 890–892*).—This paper reports further studies (E. S. R., 34, p. 63) made of the bionomics and of control measures for *Cochylis ambiguella* and *Polychrosis botrana*.

Contribution to the knowledge of Carpocapsa pomonella, G. Sciarra (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Sup. Agr. Portici, 10 (1915), pp. 33–50, fig. 1; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 1, pp. 16, 17*).—This reports studies of the bionomics of the codling moth, its economic importance, etc.

Observations of the biology of Anarsia lineatella, injurious to the almond, R. Sarra (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Sup. Agr. Portici, 10 (1915), pp. 51–65, figs. 3; abs. in Rev. Appl. Ent., Ser. A, 4 (1916), No. 1, pp. 17, 18*).—The peach twig moth is said to have two generations in Italy, the first appearing late in May and in June and July, and the second early in September and in October. In addition to almonds it attacks prunes, plums, apricots, and peaches, and has also been recorded on apples.

The fir bud moth (Argyresthia illuminatella), I. Trägårdh (*Skogen, 2 (1915), No. 7, pp. 188–191, figs. 2; abs. in Rev. Appl. Ent., Ser. A, 3 (1915), No. 11, p. 697*).—*A. illuminatella*, hitherto only recorded from Germany where it sometimes injures fir plantations, is said to be common in Sweden, although it is now recorded as a pest in that country for the first time. The larva attacks the young buds and hibernates therein, pupation taking place in May of the following year and the moths appearing in the latter half of June.

A new coconut palm pest in Java, P. E. Keuchenius (*Centbl. Bakt. [etc.], 2. Abt., 43 (1915), No. 19–24, pp. 602–609, pl. 1*).—An account of the pyralid *Melissoblaptes rufovenalis* and its injury to the coconut palm.

The classification of lepidopterous larvæ, S. B. Fracker (*Ill. Biol. Monographs, 2 (1915), No. 1, pp. 169, pls. 10*).—The first part of this work (pp. 11–40) relates to the homology of the setae, and the second or main part (pp. 41–141) consists of a systematic outline of families and genera. A glossary and bibliography are included.

Résumé of work in Peru on Phlebotomus verrucarum and its agency in the transmission of verruga, C. H. T. Townsend (*An. Zool. Aplicada, 1 (1914), No. 1, pp. 44–64, figs. 24*).—This is a summary of the author's investigations of verruga, of which accounts have been noted from other sources (E. S. R., 34, p. 355).

Behavior of Anopheles albimanus and A. tarsimaculata, J. Zetek (*Ann. Ent. Soc. Amer., 8 (1915), No. 3, pp. 221–271, figs. 6*).—This paper is largely a report of definitely observed and demonstrated flights of *A. albimanus* and its racial variety *tarsimaculata*.

"The life cycle of *A. tarsimaculata* was found to be from seven to nine days. Direct observations from boats and on land showed a distinct flight of hordes of *A. tarsimaculata* and *A. tæniorhynchus* toward Gatun, beginning at dusk, and lasting about 30 to 45 minutes. There was a return flight from Gatun to the breeding place beginning at early dawn and lasting until objects could be easily discerned, about 30 minutes duration. This return flight takes place higher in the air and is characterized by haste."

The mosquito and its relation to public health work in the Tropics and subtropics, L. E. Cooling (*Jour. Roy. Sanit. Inst., 36 (1915), No. 10, pp. 424–434, pls. 2*).—This paper includes a table which shows the difference between the more important species of mosquitoes of Brisbane, namely, *Stegomyia fasciata*, *Culex fatigans*, *Culicelsa vigilax*, and *Nyssorhynchus annulipes*, and their various stages.

The Simulidæ of northern Chile, F. Knab (*An. Zool. Aplicada, 1 (1914), No. 1, pp. 17–22, fig. 1*).—Three species are described of which one, *Simulium tenuipes*, is new to science.

The rôle played by the insects of the dipterous family Phoridæ in relation to the spread of bacterial infections.—Experiments on Aphiochæta ferruginea with the cholera vibrio, D. N. Roberg (*Philippine Jour. Sci., Sect. B, 10 (1915), No. 5, pp. 309–336*).—The experiments here reported indicate that *A. ferruginea* may serve as a possible porter or carrier of Asiatic cholera.

Notes and descriptions of Pipunculidæ, N. BANKS (*Psyche, 22 (1915), No. 5, pp. 166–170, pl. 1*).—Four species are described as new and 18 species noted as found in Virginia, making a total of 27 pipunculids recorded from that State.

Report on some parasitic and predacious Diptera from northeastern New Mexico, W. R. WALTON (*Proc. U. S. Nat. Mus., 48 (1915), pp. 171–186, pls. 2*).—This annotated list of species collected in connection with an investigation of the New Mexico range caterpillar (*Hemileuca oliviæ*) includes descriptions of several species new to science, namely, *Rhynchiodexia flavotessellata* n. sp., at Eagle Tail Mountain; *Zelia wildermuthii* n. sp., at Koehler; *Websteriana costalis* n. g.; and *Neodichocera tridens* n. g. and n. sp., at Koehler, N. Mex.

Nonintentional dispersal of muscoid species by man, with particular reference to tachinid species, C. H. T. TOWNSEND (*Proc. Ent. Soc. Wash., 18 (1916), No. 1, pp. 18–20*).

New species of Tachinidæ from New England, H. E. SMITH (*Psyche, 22 (1915), No. 3, pp. 98–102*).

[Control of the house fly], R. HULBERT (*North Dakota Sta. Spec. Bul., 4 (1916), No. 3, pp. 65–72, figs. 2*).—A summary of measures for the control of the house fly.

Does the house fly hibernate as a pupa? H. LYON (*Psyche, 22 (1915), No. 4, pp. 140, 141*).—Experiments were conducted at Harvard University during the winter of 1914–15 to determine if it is possible for the house fly to overwinter in the pupal stage.

"The results of these experiments, which represented quite natural conditions and the especially favorable conditions of the basement of the building, seem to indicate that the house fly can not easily overwinter as a pupa, although it can emerge until the middle of winter. It would seem, therefore, that the appearance of seemingly freshly emerged adults in any considerable numbers during late winter and early spring should be accounted for in some other way."

Will the Mediterranean fruit fly (Ceratitis capitata) develop in Italian lemons? G. MARTELLI (*Bol. Lab. Zool. Gen. e Agr. R. Scuola Sup. Agr. Portici, 9 (1914), pp. 161–164*).—The author fails to find evidence that *C. capitata* will develop in lemons.

The Mediterranean fruit fly (Ceratitis capitata) in the environs of Paris, P. LESNE (*Compt. Rend. Acad. Agr. France, 1 (1915), No. 16, pp. 495–497; abs. in Rev. Appl. Ent., Ser. A, 3 (1915), No. 11, p. 694*).—This fruit fly, first recorded as a source of injury to apricots in the Paris district in 1900 and the source of serious injury to peaches in 1906, was found in October, 1914, to be the source of injury to pears.

Preliminary note on a dipterous enemy of the peach, LEGENDRE (*Bul. Écon. Gouvt. Gén. Madagascar, 14 (1914), III–IV, No. 3–4, p. 242; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 6, pp. 893, 894*).—The author records the occurrence of the Mediterranean fruit fly in Madagascar.

On the Ethiopian fruit flies of the genus Dacus, M. BEZZI (*Bul. Ent. Research, 6 (1915), No. 2, pp. 85–101, figs. 14*).—Twenty species are here considered, of which six are described as new.

New American species of Asteia and Sigalsoësa, J. M. ALDRICH (*Psyche, 22 (1915), No. 3, pp. 94–98, pls. 2, figs. 2*).

The host of Zelia vertebrata, J. A. HYSLOP (*Psyche, 23 (1916), No. 1, pp. 24, 25*).—The author records the rearing of this dipteran from *Meracantha contracta.*

Notes on the cat flea (Ctenocephalus felis), H. Lyon (*Psyche, 22 (1915), No. 4, pp. 124–132, pl. 1, figs. 4*).—The notes here presented relate to the infestation of 139 cats, the seasonal abundance of the cat flea, the method of raising fleas, observations on the anatomy of the larva, etc.

The rose chafer: A destructive garden and vineyard pest, F. H. Chittenden and A. L. Quaintance (*U. S. Dept. Agr., Farmers' Bul. 721 (1916), pp. 8, figs. 4*).—This popular account of the rose chafer and methods of control is an enlarged revision of Circular 11 of the Bureau of Entomology.

The cherry leaf beetle, a periodically important enemy of cherries, R. A. Cushman and D. Isely (*U. S. Dept. Agr. Bul. 352 (1916), pp. 28, pls. 5, figs. 9*).—The present studies with *Galerucella cavicollis* were in large part conducted at North East, Pa.; observations made at the New York Cornell Station by Herrick and Matheson have been previously noted (E. S. R., 34, p. 756).

The authors find the pin, fire, or bird cherry (*Prunus pennsylvanica*) to be the natural food plant of this insect. The wild black cherry (*P. serotina*) and chokecherry (*P. virginiana*) are entirely immune from attack, even by the beetles. Among the cultivated fruits only sour cherry and peach trees are attacked, the sweet cherry and plum not being attacked at all.

The outbreak of 1915 is said to have been by far the most injurious that has ever occurred, the damage having been caused throughout two comparatively large regions, the one in the Appalachian region involving the greater part of New York, Pennsylvania, and northern West Virginia; the other in the northern part of lower Michigan, especially in the Grand Traverse region, where cherry growing is very extensive.

In the vicinity of North East, Pa., the beetle appeared on June 7, literally covering the leaves of the trees attacked, the source of the migration having been to the south of the grape belt, from cut-over forest land grown over by pin cherry, the foliage of which had been reduced by a freeze on May 27 and in part of the range by the tent caterpillar also. The beetles gradually disappeared until by the latter part of June practically all had gone, although a few scattering ones were found as late as early August.

The adult feeds almost exclusively on the underside of the leaves, eating small, irregular holes through the lower epidermis and parenchyma and sometimes through the entire leaf. To an extent it feeds also upon the fruit of the cherry, scarring and pitting it. The larvæ of all ages feed in a manner similar to the adults on the undersurface, eating through the leaf to the upper epidermis but leaving that intact. The period of economic injury of this beetle extended over 14 or 18 days after its first appearance in June.

Technical descriptions are given of its life stages. Data relating to life history studies of nearly 600 individuals, almost half of which were carried through their entire development from hatching to emergence of the adult insect, are reported upon, much of the data being presented in tabular form. The larvæ continued to hatch out as late as August 18 and were observed on pin cherry as late as September 10. The active feeding portion of the larval life in the cages varied from 10 to 20 days, the average being 12.33 days. The period spent in the ground in the cages varied from 14 to 28 days, the average being 22.36 days, and the total developmental period being from 45 to 50 days.

A small carabid beetle (*Lebia ornata*) was found to attack both pupæ and callow adults voraciously.

The control experiments conducted are briefly summarized as follows:

"Arsenate of lead must be used at a rate of not less than 5 lbs. to 50 gal. of water to be effective in protecting trees from injury by the cherry leaf beetle. A mixture to which molasses was added at the rate of 1.5 gal. to 50 gal. of the mixture was effective in killing practically all of the beetles which fed upon the

trees on which this mixture was applied. This addition of sweetening to the arsenate has the serious disadvantage of making the spray easily washed off by rains. Arsenate of lead used without molasses was less effective in protecting the trees, although it killed some beetles and it was to an extent repellent to them. Lime in the amount in which it is added to an arsenate-of-lead spray was not repellent.

"Forty per cent nicotin sulphate applied with water at the rate of 1:600, with or without soap, was effective as a contact spray. Weaker dilutions of nicotin sulphate and soap carbolic acid solutions, although apparently effective at the time of application, did not have a permanent effect. . . .

"Sweetened arsenate of lead is recommended for cherry trees because of its efficiency in killing the beetles and because its effect is continuous in favorable weather. Rain destroys the effectiveness of this spray. The combination found most useful is 5 lbs. of arsenate of lead, 1.5 gal. of molasses, and 50 gal. of water."

A bibliography of 25 titles is included.

Hyperaspis binotata, a predatory enemy of the terrapin scale, F. L. SIMANTON (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 5, pp. 197–205, pls. 2, fig. 1*).—The economic importance of this coccinellid beetle (*H. binotata*) as an enemy of lecanium scales was impressed upon the author during the course of investigations of the terrapin scale, previously noted (E. S. R., 35, p. 156). The adult beetles do not feed upon the mature scales, but destroy the young and also attack aphids and other soft-bodied insects, being particularly effective in controlling the cottony maple scale and terrapin scale. The beetle occurs in a large part of the territory east of the Mississippi River, being most abundant in the Atlantic States from Connecticut to Maryland, but is common from New Jersey to Illinois, and even extends west of the Mississippi in some States to the semiarid region.

Technical descriptions are given of its life stages. The eggs, which are salmon colored, are deposited singly on twigs adjacent to the host. The life cycle requires 39 days and is as follows: Incubation, 7 days; first instar, 3 days; second instar, 2 days; third instar, 3 days; fourth instar, 12 days; and pupa, 12 days.

Wireworms destructive to cereal and forage crops, J. A. HYSLOP (*U. S. Dept. Agr., Farmers' Bul. 725 (1916), pp. 10, figs. 6*).—This is a general discussion of wireworms and their control based upon the author's investigations, previously noted (E. S. R., 32, p. 555).

Prothetely in the elaterid genus Melanotus, J. A. HYSLOP (*Psyche, 23 (1916), No. 1, pp. 3–6, pls. 2, fig. 1*).

Elateridæ and Throscidæ of the Stanford University expedition of 1911 to Brazil, J. A. HYSLOP (*Psyche, 23 (1916), No. 1, pp. 16–21, pl. 1, fig. 1*).

Observations on the life history of Meracantha contracta, J. A. HYSLOP (*Psyche, 22 (1915), No. 2, pp. 44–48, pl. 1, figs. 2*).

Notes on the habits of weevils, W. D. PIERCE (*Proc. Ent. Soc. Wash., 18 (1916), No. 1, pp. 6–10*).

The buff-colored tomato weevil (Desiantha nociva), W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 26 (1915), No. 12, pp. 1065, 1066*).—This weevil has a wide range over the eastern and southern coasts of Australia. In New South Wales it damages the young buds and shoots of fruit trees and vines in early summer, but was not known as a serious field-crop pest until 1915.

Beekeeping in Wisconsin, N. E. and L. V. FRANCE (*Wisconsin Sta. Bul. 264 (1916), pp. 3–28, figs. 11*).—A general account based upon many years' experience, the senior author having been state apiary inspector for a period of 18 years.

Texas beekeeping, L. H. Scholl (*Texas Dept. Agr. Bul. 24, 2. ed. (1912), pp. 142, figs. 115*).—A second edition of this manual (E. S. R., 27, p. 864).

Annual reports of the Bee Keepers' Association of the Province of Ontario, 1913 and 1914 (*Ann. Rpts. Bee Keepers' Assoc. Ontario, 1913, pp. 72; 1914, pp. 78, fig. 1*).—The proceedings of the annual meetings of the association for the years 1913 and 1914.

Horismology of the hymenopterous wing, S. A. Rohwer and A. B. Gahan (*Proc. Ent. Soc. Wash., 18 (1916), No. 1, pp. 20–76, figs. 11*).

British ants, their life history and classification, H. St. J. K. Donisthorpe (*Plymouth, England: William Brendon & Son, Ltd., 1915, pp. XV+379, pls. 18, figs. 92; rev. in Science, n. ser., 43 (1916), No. 1105, pp. 316–318*).—This comprehensive guide to the study of the British ants is based upon the author's twenty years of labor and experience. In the introduction (pp. 3–64) the external and internal structure, life history, psychology, geographical distribution, geological record, collecting, and observation are considered, following which the indigenous genera and species (pp. 65–334) and cosmopolitan and introduced species (pp. 334–350) are dealt with.

A bibliography of 15 pages and a systematic index to British ants and myrmecophiles are appended. The review is by W. M. Wheeler.

Two new species of Cerceris, N. Banks (*Ent. News, 27 (1916), No. 2, pp. 64, 65*).

A revision of the Ichneumonidæ based on the collection in the British Museum (Natural History), with descriptions of new genera and species, C. Morley (*London: Brit. Mus. Nat. Hist., 1915, pt. 4, pp. XII+167, pl. 1*).—This fourth part of the work previously noted (E. S. R., 31, p. 656) deals with the tribes Joppides, Banchides, and Alomyides of the subfamily Ichneumoninæ.

Descriptions of six new species of ichneumon flies, R. A. Cushman (*Proc. U. S. Nat. Mus., 48 (1915), pp. 507–513*).—The species here described as new are ***Bassus carpocapsæ***, *Aenoplex carpocapsæ*, ***A. plesiotypus***, and ***Glypta brevis*** reared from the codling moth, at South Acton, Mass., Vienna, Va., Alameda, Cal., and French Creek, W. Va., respectively; ***Notopygus virginiensis*** from Vienna, Va.; and *Idechthis nigricoxalis* reared from ***Euzophera semifuneralis*** at Youngstown, N. Y.

Some new chalcidoid Hymenoptera from North and South America, A. A. Girault (*Ann. Ent. Soc. Amer., 8 (1915), No. 3, pp. 272–278*).—Four genera, 6 species, and 2 varieties are here described as new. Of these *Eunotus americanus*, reared from *Eriopeltis festucæ* at Portland, Me., and *Anagrus armatus nigriceps*, reared from eggs of *Empoasca rosæ* at Corvallis, Oreg., are of economic importance.

Descriptions of new genera and species, with notes on parasitic Hymenoptera, A. B. Gahan (*Proc. U. S. Nat. Mus., 48 (1915), pp. 155–168*).—In this paper descriptions are given of three species of Ichneumonoidea and two genera and ten species of Chalcidoidea new to science, including *Hyposoter interjectus* reared from *Prodenia ornithogalli* at Arcola, Miss.; *Nepiera benevola* from *Eurymus eurytheme* at Salt Lake, Utah; *Aphæreta sarcophagæ* from *Sarcophaga kellyi* at Wellington, Kans.; *Liodontomerus perplexus* and *Trimeromicrus maculatus* n. g. and n. sp., at Yuma, Ariz.; *Habrocytus medicaginis* at Glendale, Cal., and *Tetrastichus venustus* at Corcoran, Cal., from alfalfa seed pods infested with *Brucophagus funebris*; *Anastatus semiflavidus* from *Hemileuca oliviæ* at Koehler, N. Mex.; *Eupteromalus sarcophagæ* from *S. kellyi* at Dodge City, Kans.; *Euplectrus insuetus* from *Lorema accius* at Lakeland, Fla.; *Diaulinus insularis* from *Agromyza inæqualis* at Rio Piedras, P. R.; and *Tetrastichus euplectri* from *Euplectrus platyhypenæ* at Tallulah, La.

New chalcidoid Hymenoptera, A. A. GIRAULT (*Ann. Ent. Soc. Amer., 8 (1915), No. 3, pp. 279–284*).—One genus and 8 species are here described as new to science, among which is *Aphidencyrtus aspidioti*, reared from *Aspidiotus perniciosus* at Lansing, Mich. *Coccidencyrtus ensifer* is recorded as reared from *Aspidiotus juglans-regiæ* at Muskegon, Mich.

Chalcidoidea bred from Glossina morsitans in Northern Rhodesia, J. WATERSTON (*Bul. Ent. Research, 6 (1915), No. 1, pp. 69–82, figs. 5*).—Three species representing as many widely separated groups in the superfamily Chalcidoidea are considered, two of which are described as new to science.

Two new Mymaridæ from the eastern United States, A. A. GIRAULT (*Ent. News, 27 (1916), No. 2, pp. 69, 70*).

Notes on some sawfly larvæ belonging to the genus Dimorphopteryx, W. MIDDLETON (*Proc. U. S. Nat. Mus., 48 (1915), pp. 497–501, pl. 1, figs. 4*).—These notes relate to *Dimorphopteryx castaneæ* on chestnut at Falls Church and Wiehle, Va., and Blythedale, Md.; *D. autumnalis* on red oak at Falls Church and Wiehle, Va.; *D. quercivora* on red oak at Tomahawk Lake, Wis.; and *D. errans* on birch and linden.

Ticks: A monograph of the Ixodoidea.—Bibliography of the Ixodoidea, II, G. H. F. NUTTALL and L. E. ROBINSON (*Cambridge: University Press, 1915, pp. [4]+32*).—This addition to the bibliography previously noted (E. S. R., 25, p. 858) lists 462 papers, a large proportion of which have appeared since the publication of the first part.

Ticks: A monograph of the Ixodoidea, III, The genus Hæmaphysalis, G. H. F. NUTTALL and C. WARBURTON (*Cambridge: University Press, 1915, pp. XIII+349–550, pls. 9, figs. 143*).—The authors recognize 50 species and varieties, including the three species *H. spinulosa*, *H. obtusa*, and *H. numidiana*, the validity of which is somewhat doubtful. The synonymy and references relating to publications which deal with the genus Hæmaphysalis and the generic characterization are followed by keys for the determination of the species of the genus, including males, females, nymphs, and larvæ, so far as known. Specific descriptions of valid species of the genus and of their varieties, which take up the greater part of the work (pp. 362–506), are followed by an account of the geographical distribution and hosts of the genus; a list of condemned and doubtful species of Hæmaphysalis, including their synonymy and literature; notes on the biology of Hæmaphysalis (pp. 518–547), by G. H. F. Nuttall; and an index to valid species of the genus, together with a list of collections in which the types are to be found.

The cassava mite, S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 14 (1915), pp. 35, pls. 3; abs. in Rev. Appl. Ent., Ser. A, 3 (1915), No. 11, p. 632*).—The red spider which injures cassava in Java is *Tetranychus bimaculatus* or closely related to it. Stripping and burning the leaves is the only remedial measure thus far found to give satisfactory results.

The leaf blister mite of pear and apple, A. L. QUAINTANCE (*U. S. Dept. Agr., Farmers' Bul. 722 (1916), pp. 6, figs. 4*).—A reprint of Bureau of Entomology Circular 154, previously noted (E. S. R., 27, p. 565).

On a widely distributed gamasid mite (Leiognathus morsitans n. sp.), parasitic on the domestic fowl, S. HIRST (*Bul. Ent. Research, 6 (1915), No. 1, pp. 55–58, figs. 3*).—*L. morsitans*, here described as new, is said to have a very wide distribution in Africa and also to be found in Mauritius, China, India, and South America. It appears to be the common bloodsucking gamasid mite of poultry in these countries.

On some new acarine parasites of rats, S. Hirst (*Bul. Ent. Research, 6 (1915), No. 2. pp. 183–190, figs. 8*).—Four mites from rats are described for the first time, one being a new species of Lælaps which occurs in Ceylon, India, Africa, and South America, while the three others are larval forms of Trombidiidæ collected in India.

Two Mexican myrmecophilous mites, N. Banks (*Psyche, 22 (1915), No. 2, pp. 60, 61, figs. 2*).

FOODS—HUMAN NUTRITION.

The infection of foods by bacteria, M. Bornand (*Bul. Soc. Vaud. Sci. Nat., 5. ser., 50 (1915), No. 187, pp. 589–619*).—Information is given regarding the infection of milk, bread, eggs, meat, and drinks by pathogenic bacteria. The most effective preventive measures are thought to be rigorous inspection of all places where foods are prepared, handled, and sold; protection from insects, especially flies, by suitable screening; and personal inspection.

Feeding experiments with Bacterium pullorum.—The toxicity of infected eggs, L. F. Rettger, T. G. Hull, and W. S. Sturges (*Jour. Expt. Med., 23 (1916), No. 4, pp. 475–489*).—Earlier work by the senior author (E. S. R., 31, p. 171) on the bacteriology of normal, fresh eggs is referred to and attention is called to the widespread occurrence of *Bacterium pullorum* in eggs and its possible significance in food poisoning.

The investigation here reported consisted of two parts—a study of the toxicity of *B. pullorum* when administered orally, either with food or by means of a pipette, and also an investigation of the heat tolerance of *B. pullorum* in infected eggs which were prepared for edible use by the ordinary processes of boiling, coddling, frying, etc.

Laboratory animals (rabbits, kittens, guinea pigs, and white rats) were fed varying amounts of water suspensions of cultures of several different strains of *B. pullorum*. Post-mortem examinations were made of the animals which died and also of control animals, the results of the experiments being reported in detail.

The results of these tests showed that "eggs which harbor *B. pullorum* in the yolk in large numbers may produce abnormal conditions, when fed, not only in young chicks, but in adult fowls, young rabbits, guinea pigs, and kittens. The toxicity for young rabbits is most pronounced, the infection usually resulting in the death of the animals. In kittens the most prominent symptoms are those of severe food-poisoning with members of the paratyphoid group of bacteria."

Fresh eggs were infected with *B. pullorum* by injecting a small amount of water suspension of the organism into the yolk by means of a sterile hypodermic syringe. The infected eggs were incubated from three to five days and then cooked in different ways, after which they were examined for the presence of the organisms. These tests showed that poaching the eggs for from one-half to four minutes rendered them sterile. Also no visible organisms were recovered from infected eggs which had been scrambled. In the case of fried and coddled eggs the organisms were recovered from the cooked eggs in some cases and not in others. Even boiling the eggs for four minutes did not in every instance destroy the organisms, this resistance being attributed by the authors to the protection afforded by the shell, the egg white, and the yolk itself.

The authors state that the possibility of danger from infection with *B. pullorum* can not be ignored, especially in the case of invalids and young children.

"Ovarian infection of fowls is very common throughout this country. Hence a large proportion of the marketed eggs are infected with *B. pullorum*. When

such eggs are allowed to remain in nests under broody hens or in warm storage places for comparatively few hours they contain large numbers of the organism.

"Soft boiling, coddling, and frying on one side only do not necessarily render the yolks free from viable bacteria; therefore eggs which have gone through these processes may, like raw eggs, be the cause of serious disturbances in persons who are particularly susceptible to such influences, and especially in infants. That no well-authenticated instances of egg poisoning of this kind are on record does not warrant the assumption that there have been no cases. The etiology of infantile stomach and intestinal disturbances is as yet too little understood; in fact, it may be said that many of these disorders have no known cause, and almost as much may be said regarding gastro-intestinal diseases in later life. Furthermore, since the ailments caused by infected eggs would not make themselves felt, presumably, until several days after their ingestion, little or no suspicion would fall upon the eggs. It may be said, too, that the wide distribution of ovarian infection in the domestic fowl has come about only in the last few years, hence its possible danger to man is one of recent development."

Turning green of oysters and their content of heavy metals, F. LIEBERT (*Chem. Weekbl., 12 (1915), No. 44, pp. 978–983*).—A summary and digest of data concerning the causes of the green color of certain varieties of oysters. In some cases the color is said to be due to algæ and in others to a high copper content.

[Milling and baking tests of wheat] (*North Dakota Sta., Rpt. Dickinson Substa., 1913, pp. 20–22*).—A brief report is made of the results of milling and baking tests made upon 8 samples of wheat.

A study of certain conditions which affect the activity of proteolytic enzyms in wheat flour, C. O. SWANSON and E. L. TAGUE (*Jour. Amer. Chem. Soc., 38 (1916), No. 5, pp. 1098–1109*).—The experiments here reported were carried out in continuation of previous work (E. S. R., 30, p. 164), and were designed to study the effects of a number of conditions on the activity of proteolytic enzyms in wheat flour, especially the effects of the inorganic compounds, potassium dihydrogen phosphate, potassium orthophosphate, potassium hydroxid, potassium sulphid, ammonium chlorid, calcium chlorid, and hydrochloric acid, and the organic substances, dried egg albumin, egg albumin digested in water at different temperatures, and casein. Descriptions are given of the method used, which was that of titration with formol to determine the amount of amino nitrogen present in the flour and as a means of measuring the protein cleavage due to proteolytic enzyms present.

Of the various salts tried, ammonium chlorid and calcium chlorid had the greatest accelerating effect on the rate of protein cleavage. "The proteolytic enzyms present in wheat flour caused a more rapid hydrolysis of the proteins when desiccated egg albumin was present, but not when casein was used."

The nature of the dietary deficiencies of the wheat embryo, E. V. MCCOLLUM, NINA SIMMONDS, and W. PITZ (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 105–131, figs. 19*).—The authors refer to earlier work, especially that reviewed (E. S. R., 33, p. 666; 34, pp. 367, 368; 35, p. 166), and discuss the results of these earlier investigations briefly, in so far as they bear on human nutrition. The method pursued in the work by the authors is based on the following line of reasoning: "If a single natural food product fails to nourish an animal adequately, it may be due to (a) lack of sufficient protein or to proteins of poor quality; (b) an unsatisfactory mineral content due either to inadequacy of certain elements in amount, or to unsatisfactory proportions among them; (c) an inadequate supply of the fat-soluble A; (d) of the water-soluble B; (e)

or some toxic substance contained therein. One, two, three, four, or all of these factors may operate in inducing nutritive disturbances."

Experiments with laboratory animals (rats) are reported, in which was studied the effect of feeding wheat embryo alone or with other ingredients.

It is concluded that "the wheat embryo contains qualitatively all the factors essential for the promotion of growth and well-being in an animal, but these are not so proportioned that it can serve as a satisfactory diet without several modifications. The mineral content must be modified in certain respects before growth can proceed at all.

"The character of the proteins is excellent; no other proteins from plant sources which we have studied are superior to them. Rations containing but 10 per cent of these proteins are wholly adequate for growth at the maximum rate.

"Both the fat-soluble A and the water-soluble B, the factors which must be supplied by an adequate diet, but whose chemical natures are as yet unknown, are present; the first, in moderate concentration; the second, in very high concentration, as measured by the needs of the growing animal. Two per cent of wheat embryo supplies enough of the water-soluble B to promote growth at the normal rate for several months."

The wheat germ contains a substance which is toxic to animals. This factor is found in the fat fraction and is to a great extent removed by ether extraction. It has not yet been determined whether the toxicity is due to the chemical nature of the fats or to some substance associated with them.

The use of the butia palm as a food, J. Puig y Nattino (*Insp. Nac. de Ganadería y Agr.* [*Uruguay*], *Bol. 16* (*1915*), *pp. 18*).—The palm herein described is an ornamental tree from which a number of food products are obtained. Analyses are given of the fruit, seeds, fiber, leaves, and the juice of the shoots (from which a honey is made).

The preparation and utilization of yeast as food, W. Völtz (*Ztschr. Spiritusindus., 39* (*1916*), *Nos. 7, pp. 53, 54; 8, pp. 64, 65*).—In continuation of previous work (E. S. R., 34, p. 165), the author reports experimental data regarding the composition, digestibility, and uses of brewery yeast and of yeast cultivated in a medium of sugar and inorganic salts.

Dried yeast containing 95 per cent of water-free material was found to contain from 50 to 60 per cent of protein, 2 to 4 per cent of fat, 25 to 30 per cent of carbohydrate, 6 to 8 per cent of ash, and nearly 2 per cent of phosphatids. In digestion experiments with men the protein, fat, and nitrogen-free extract were 86, 70, and 100 per cent digested, respectively, and the energy was 88 per cent available.

Honey in antidiabetic diet, A. Y. Davidoff (*Russ. Vrach, 14* [*1915*], *No. 26; abs. in Jour. Amer. Med. Assoc., 65* (*1915*), *No. 16, p. 1412*).—Observations in seven cases of diabetes of the effect of using honey in the diet as a substitute for sugar and other sweet foodstuffs indicate that it prevents acetonuria and diminishes the sugar content of the urine.

The content of stems in Java tea and the testing of tea, J. J. B. Deuss (*Chem. Weekbl., 13* (*1916*), *No. 3, pp. 66–71*).—Analytical data are given showing the percentage of stems in different kinds of tea. The more expensive brands of tea were found to contain a higher percentage of stems than the less expensive kinds, indicating that the evaluation of tea should not be made on the basis of stem content.

The composition of Hungarian wines, M. Vuk (*Kisérlet. Közlem., 18* (*1915*), *No. 5–6, pp. 813–830*).—Data are given which show the composition of Hungarian wines, principally from the output of 1913, and some general information regarding the production and exportation of wines during the year 1913.

[Food and drug anlyses], E. F. Ladd and Alma K. Johnson (*North Dakota Sta., Spec. Bul., 4 (1916), No. 3, pp. 72–80*).—This part of the bulletin contains a report on prepared mustard by R. E. Remington, which includes analytical data. Information is also given regarding some proprietary medicines examined, and the results are reported of the analysis of several samples of foods and beverages.

The economics of electric cooking, P. W. Gumaer (*Univ. Missouri Bul., 16 (1915), No. 27, pp. 62, figs. 37*).—The object of the investigation here reported was to ascertain some of the factors which increase the economy of electric cooking. Tests were made with three commercial and several especially constructed experimental ovens, in order to determine the amount of energy consumed in cooking, and the best methods of preparing different foods for the electric oven. The details of construction of the ovens are described in the bulletin, as are also the method of measuring by means of copper-constantan thermocouples, the temperatures of the ovens and the internal temperature of the foods during cooking. The experiments furnished considerable information as to the losses of energy in electric ovens due to convection and radiation, preheating, and the opening of the oven door.

"The energy lost when the door of an electric oven is opened for 15 seconds was determined for various oven temperatures. For an oven temperature of 200° C. (392° F.) used in baking bread, biscuits, etc., the loss due to opening a 12-inch by 18-inch oven door for 15 seconds amounted to 12 watt hours. At 5 cts. per kilowatt hour for electric current this would mean a cost of 0.06 ct. each time the door was opened for a period of 15 seconds.

"Since the purpose of cooking food is not to put as many heat units as possible into the food, but is rather to improve its flavor, and to increase its digestibility, the steam boiler method of determining efficiency is not applicable to electric ovens."

Considerable space is devoted to a discussion of the general efficiency of electric ovens. "In order to compare the cost of cooking in various electric ovens, a method proposed for indicating the relative efficiency of the electric ovens is to specify the amount of the preheating and the radiation losses at the required oven temperatures."

Experiments were undertaken to determine the most satisfactory and economical temperatures for roasting beef. Twenty-two rib roasts of like size and quality were boned, rolled, and roasted at 100, 120, 140, 160, and 180° C., the time required for the cooking, the loss in weight, and the amount of energy consumed at each temperature being measured. To secure uniform results in the degree to which the meat was cooked, each piece was removed from the oven when the interior reached a definite temperature. An inner temperature of 55° was taken to indicate meat that was rare, 65° medium rare, and 75° well-done meat, since these figures conformed to the usage of other experimenters. A table is given which shows the temperatures of the roasts on removal from the oven which gave the most satisfactory results as regards quality of the meat. The searing of the meat previous to roasting was accomplished in an open aluminium dish over a heating coil, this method being found to result in a saving of 5 cts., on the basis of 5 cts. per kilowatt hour for electric current, over the method of heating the whole oven up to 250° for 10 to 15 minutes in order to sear the outside of the meat.

Figures are given which show the time temperature curves for the inside of the roasts for different oven temperatures, which are of especial interest in cooking studies. "The shortest time of roasting was at 160°.

"The percentage loss of weight of the roasts was found to increase with the oven temperature used."

Other figures show the effect of oven temperature on the time of cooking of beef roasts and on losses in weight and the energy required to roast beef under different conditions.

"The energy required for roasting a rolled rib roast of beef in three types of electric ovens was determined for oven temperatures from 100 to 180°. The most economical temperature for preparing rare and medium-rare roasts was found to be 100° in each oven. For well-done roasts 120° is the most economical temperature."

A series of experiments were also carried out on the baking of biscuits, bread, and sponge cakes, in order to determine the range of temperature in which each of these could be most satisfactorily and at the same time economically baked. Curves are given which show the effect of oven temperature on the time of baking and the percentage of loss in weight and the energy required to bake each article under different conditions.

"The range of oven temperatures for baking biscuits was found to be from 200 to 240°. Starting with the oven at the required temperature, the energy used in making biscuits is practically the same for all oven temperatures. If it is necessary to heat up the oven from room temperature, the most economical oven temperature is the lowest which will give satisfactory results; i. e. about 200°.

"The range of temperatures for baking a small-sized loaf of bread was found to lie between 180 and 240°. Starting with the oven at the required temperature, the most economical temperature for baking bread is between 220 and 240°. When preheating is included, the most economical temperature for a small-sized loaf was found to be between 200 and 215°.

"The range of temperature for baking sponge cake was found to lie between 170 and 190°. For baking sponge cake the most economical oven temperature is the highest temperature which will give satisfactory results; i. e., about 190°. . . .

"For baking at the higher temperatures a heating element in the upper part of the oven is necessary to get the best results. Without the upper heating coil the bread, cake, or biscuits will burn on the bottom before they are satisfactorily browned on top. For the lower temperatures this upper coil is unnecessary."

It was also a feature of the experiments to determine the most economical thickness of heat insulation. It was concluded that "with electricity at 5 cts. per kilowatt hour and allowing an interest and depreciation charge of 25 per cent, the most economical thickness of kieselguhr insulation was found for domestic use to lie between 3 and 4 inches."

In conclusion the author emphasizes the importance in electric cooking of accurate temperature measurements, adequate means of controlling the temperature of the food, and the formulation of definite rules or directions for the cooking of each article. A number of suggestions are given for the construction and operation of electric ovens to secure the best results.

Nutritional physiology, P. G. Stiles (*Philadelphia and London: W. B. Saunders Co., 1916, 2. ed., pp. 288, pls. 4, figs. 19*).—The first edition of this book has been previously noted (E. S. R., 28, p. 763).

Hunger and food, G. J. Peirce (*Sci. Mo., 2 (1916), No. 2, pp. 181–188*).—This article considers some economic aspects of the food supply.

The amino-acid minimum for maintenance and growth, as exemplified by further experiments with lysin and tryptophane, T. B. Osborne, L. B. Mendel, et al. (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 1–12, figs. 4*).—In explanation of the fact that adequate growth has never been obtained with rations in which the nitrogenous components do not furnish sufficient proportions of

amino acids, such as tryptophane, lysin, or cystin, the authors state that an essential feature of the construction of new tissue is a synthesis of new protein. Growth will, therefore, be limited by any factor preventing this synthesis, such as the lack of any component amino acid which can not be manufactured directly in suitable amounts by the body. The authors review briefly earlier experiments by themselves and others, which show the effects of tryptophane, lysin, and cystin upon growth when added to an otherwise deficient ration.

Additional experiments with laboratory animals (rats) are reported which show that "the need for tryptophane and lysin is governed by the 'law of minimum,' the rate of growth increasing with increasing amounts of these amino acids furnished by the food until the normal rate is attained. When larger quantities of these amino acids are supplied growth is not made more rapidly, for the construction of new tissue is no longer limited by deficiencies in the requisite supply of any element of the food, but by the natural capacity of the animal to grow."

The energy content of the diet (*Sci. Mo., 2 (1916), No. 3, pp. 279–306*).—The following four papers form a symposium and were read before the Section of Physiology and Experimental Medicine of the American Association for the Advancement of Science, at Columbus, Ohio, in December, 1915:

Proteins in growth, by Ruth Wheeler (pp. 279–282).—This paper summarizes the results of recent investigations relative to the rôle of amino acids in nutrition and emphasizes the importance of the amino acid content, as well as other characteristics of proteins, in determining their food value.

The mineral nutrients in practical human dietetics, by E. B. Forbes (pp. 282–289).—In this article the author enumerates the functions of the mineral elements in metabolism and discusses their importance in the diet. The bulk of the material is essentially the same as that noted in an earlier paper (E. S. R., 35, p. 62).

The chemical nature and physiological significance of so-called vitamins, by C. Voegtlin (pp. 289–293).—Recent investigations by the author and others are summarized and the importance of vitamins in practical dietetics is considered. A table is given showing the common foods which are relatively rich and relatively poor in antineuritic and antiscorbutic properties.

Food selection for rational and economical living, by C. F. Langworthy [a] (pp. 294–306).—The author considers at length a number of factors which should be taken into account in securing an adequate and economical diet which at the same time gives satisfaction. Information is given regarding the selection, preparation, and cooking of foods, and the planning of meals.

As a guide for the housekeeper in the wise selection of food materials for a meal or for a day's ration, and also as a means of checking up and criticizing meals served, the author classifies the common foods into five groups, corresponding to their distinctive functions in nutrition. "The groups may be described in terms of the dietitian as follows: (1) Foods in which protein bears a higher proportion to fuel value than it does in the well-chosen diet as a whole; (2) those in which fuel value is high in proportion to protein, owing chiefly to the presence of much starch; (3) those in which fuel value is high, owing to the large percentage of fat; (4) those whose chief value is mineral constituents and vegetable acids (the latter important from the standpoint of flavor as well as of body needs); and (5) those which (like the foods in Groups 2 and 3) have a high fuel value, but in this case due to the presence of sugar. From the standpoint of fuel value only, it is obvious that Groups 2 and 5 could be combined. From the standpoint of the well-chosen and palatable meal, on the other

[a] Sci. Amer. Sup., 81 (1916), Nos. 2100, pp. 210, 211; 2101, pp. 230, 231.

hand, they should be kept distinct, since sugar is frequently as important as a flavor as it is as a food."

In discussing the practical use of this grouping of foods by the housekeeper, sample menus for the day's meals are given which contain food materials which are wholesome but combined in such a way as to furnish an excess of protein, fat, and carbohydrate.

ANIMAL PRODUCTION.

Silage investigations: Normal temperatures and some factors influencing the quality of silage, C. H. ECKLES, O. I. OSHEL, and D. M. MAGRUDER (*Missouri Sta. Research Bul. 22 (1916), pp. 3–32, figs. 7*).—In these investigations various types of silos were used, including the concrete, iron, stave, and tile silos, as well as small experimental silos. Temperature readings were taken by means of electrical resistance thermometers placed in half-inch iron pipe, and the wires carried to the surface of the silage so that readings could be taken.

It was found that in the climate of Missouri the temperature of silage when put in the silo will generally range from 75 to 95° F. The temperature rises from 3 to 15°, reaching a maximum in from eight to twelve days. From this point on the temperature of the silage slowly declines. Where sufficient moisture is present and the silage is well packed the highest temperature will rarely exceed 100°. By December 1 the temperature reaches a point between 60 and 70°, and the lowest point, 50 to 60°, is reached by March.

The temperature in the silage in the early stage is influenced to some extent by the temperature of the atmosphere at the time of filling, and of the water used, if any be added. The greatest factor causing variations in the temperature in a silo is the amount of air contained in the silage. It was found, experimentally, that the presence of air and the resulting growth of mold increased the temperature in every case. The material used in the construction of the silo has but little, if any, influence upon the temperature of the silage.

In an experiment planned to determine the relation of the temperature in the silo to the quality of the silage produced, six cans holding about 10 gal. each were filled with corn from a large concrete silo while it was being filled. The corn was thoroughly packed in the cans and covers provided which would slip inside the cans. The cans were then placed in a screw press and heavy pressure applied. The lids were securely fastened before the pressure was removed and the cover was sealed around the edges with paraffin to exclude the air. Two cans were placed in a cooling room at a temperature of approximately 50°, two at a temperature of 68°, and the other two at a temperature of 100°. Twenty-three days after filling one can from each lot was opened, the silage compared as to appearance, odor, and taste, and samples were taken for acidity, moisture determinations, and chemical analysis. The three remaining cans were opened 58 days after filling.

No marked difference in the composition of the silage fermented at the three temperatures used was obtained. The acidity was decidedly the highest in the lot at medium temperatures. The protein showed practically no variation, and the ether extract was practically the same in all, or was within the limits of error in making such analyses. There was some difference noticeable in the figures for crude fiber and nitrogen-free extract. In each case the percentage of crude fiber decreased between the date of the first sample and that of the second. It would seem safe to attribute this to the effect of the fermentation. The nitrogen-free extract was the highest in the lot at medium temperature and the lowest at the high temperature.

The highest loss in dry matter occurred at the highest temperature. It was evident from the odor and taste that there was considerable difference in the character of the fermentation which took place at the three temperatures, but all three lots would have passed as normal silage, although the lot at medium temperature was rather better than the lot at 50°, while that fermented at 100° was ranked slightly superior to the medium. Apparently a medium temperature from 77 to 85° is the most favorable for silage fermentations, but the results indicate that the limits can be extended to 60 and 100° at least without any material difference in the results. Temperatures much above this are not desirable, since such a temperature must mean the oxidation or destruction of some of the silage material to furnish the heat.

It is deemed evident that the quality of the silage produced will not be influenced by any effect upon temperature of the material used in constructing the silo, as analyses of silage from the wall and center of silos of various types of construction showed no difference in composition due to the materials used.

A comparison of silage from a large silo and of silage from the same corn put into a small experimental silo showed the quality to be the same, as judged by appearance and by chemical analysis. For all purposes, except studying temperature changes, the small silo is believed sufficiently accurate for experimental purposes. The experimental silos used were water tanks 3 ft. in diameter and 6 ft. high and constructed of 2-in. cypress. A wooden cover was made to fit loosely and was provided with a ring of felt around the edge to make a reasonably tight joint. Weight was applied in the form of 1,500 lbs. of rock. This was estimated to equal the pressure to which silage is subjected at a point one-third of the distance from the top of a silo containing 28 ft. of average silage.

Feeding coconut cake on grass, K. J. J. MACKENZIE and E. H. POWELL (*Jour. Bd. Agr.* [*London*], *23* (*1916*), *No. 2, pp. 117–123*).—Feeding experiments with steers indicate that coconut cake, when suitable in price, is a valuable feed for steers on grass, but that it is not very palatable and so should be gradually introduced into a mixture of palatable feeds. It is advised that the amount be restricted to 50 per cent of the concentrated ration, and that it be fed with something rather constipating, such as cotton cake. It is stated that a daily ration of 4 lbs. of a mixture of coconut cake, cotton cake, and linseed cake, 3 : 3 : 2, appears to give the best results.

The industrial utilization of the waste product of rice hulling, N. NOVELLI (*Gior. Risicolt.*, *5* (*1915*), *No. 15, pp. 242, 243*).—The results of feeding experiments are given which indicate that the flour waste product from rice hulling is easily digested and highly nutritious. The readiness with which the product becomes sour is an obstacle to its general use. It is suggested that it be converted into cakes, in which form it would keep for a long time and could be easily transported.

The nutrition of farm live stock, especially cattle, W. KLEIN (*Biochem. Ztschr.*, *72* (*1915*), *No. 3–4, pp. 169–252, figs. 2*).—This article reports a comparative study made of the Zuntz, Regnault-Reiset, and Pächtner methods of metabolism measurement.

It is concluded that the Zuntz method of gas interchange measurement is the best for determining the influence of the biological processes on the gas interchange, but there appears to be a close agreement with all three methods. The calculation of the energy balance alone by respiration experiments, that is O_2 consumption and CO_2 elimination, when compared with the chemical analysis of the intake and outgo was in close agreement.

It was found that the castration of bulls was without influence on the energy assimilation. It was demonstrated that more than 14 per cent of the total carbon dioxid elimination in cattle was by way of the skin and intestines.

The results of these experiments showed a higher energy consumption for older steers than those secured by Dahm (E. S. R., 25, p. 674), but were in close agreement with the Armsby calorimeter results (E. S. R., 15, p. 799). It was apparent that the maintenance requirements in the various ages of cattle were in proportion to the body surface.

Nondisjunction as proof of the chromosome theory of heredity, C. B. Bridges (*Genetics, 1 (1916), Nos. 1, pp. 1–52, pl. 1, figs. 8; 2, pp. 107–163, pl. 1, fig. 1*).—In this paper experimental proof is offered that "particular chromosomes, the X chromosomes, are the differentiators of sex; the X chromosome constitution of an individual is the cause of the development by that individual of a particular sex, and is not the result of sex already determined by some other agent. The sex is not determined in the egg or the sperm as such, but is determined at the moment of fertilization; for the X sperm of the male gives rise to a female when it fertilizes an egg containing an X, but to a male if it fertilizes an egg containing a Y or no sex chromosome at all. Likewise the Y sperm of a male gives rise to a female when fertilizing an XX egg and to a male when fertilizing an X egg. These facts in connection with the fact that an X egg of a female produces a male if fertilized by an X sperm prove that the segregation of the X chromosomes is the segregation of the sex differentiators. The presence of two X chromosomes determines that an individual shall be a female, the presence of one X that the individual shall be a male. The origin of these chromosomes whether maternal or paternal is without significance in the production of sex.

"The Y chromosome is without effect upon the sex or the characters of the individual, for males may have one Y, two Y's, or may lack Y entirely (males lacking Y are sterile); and females may have one or two supernumerary Y's with no change in appearance in any case."

A bibliography of references is appended.

A sex-limited color in Ayrshire cattle, E. N. Wentworth (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 4, pp. 141–147*).—It is stated that a case which seems to fall under the sex-limited group is found in the inheritance of black and white as alternative to red and white in Ayrshire cattle. If the factor for the black and white color is represented by *B*, the hereditary constitutions are as follows: *BB* is always black and white; *bb* is always red and white; and *Bb* is always black and white in the male and red and white in the female.

In breeding experiments at the Kansas Experiment Station all of the nine possible matings were discovered. From the data obtained it appears that the black and white color of Ayrshire cattle behaves in an ordinary sex-limited manner similar to the horns in sheep as discussed by Wood [a] and the rudimentary mammae in swine as reported by the author (E. S. R., 27, p. 769).

It is concluded that black and white color is a simple allelomorph of red and white color in Ayrshire cattle. In the male the black and white character is dominant and in the female the red and white character is dominant. Males heterozygous for the two characters are black and white, while females heterozygous for the two characters are red and white.

Sheep raising in Wisconsin, F. Kleinheinz (*Wisconsin Sta. Bul. 263 (1916), pp. 19, figs. 11*).—This bulletin deals with the opportunities for successful sheep raising in Wisconsin and the methods of care, feeding, and management.

Fish meal as food for pigs, C. Crowther (*Jour. Bd. Agr.* [*London*], *23 (1916), No. 1, pp. 27–33*).—Pigs fed fish meal in addition to a basal ration of bran and middlings made 1.35 lbs. greater gains per pig weekly than those fed

[a] Jour. Agr. Sci., 1 (1905), No. 3, pp. 364, 365.

the basal ration alone. When slaughtered the fish-fed pigs showed no undesirable appearance, color, or smell in any part of the carcass, and at no stage of cooking could an exceptional smell or flavor be detected.

Large-type swine and fertility, E. N. WENTWORTH (*Breeder's Gaz., 69 (1916), No. 13, pp. 722, 723*).—In an investigation conducted at the Kansas Experiment Station 1,000 litters of large-type Poland-Chinas and 1,100 litters of small-type Poland-Chinas were compared for average size. The large type farrowed litters of 7.854 pigs on the average, while the small type farrowed 7.896 pigs, the difference in fertility between the two strains of swine thus being insignificant.

The average amount that the group of large-type sows varied from its average litter, 2.141 pigs per litter, was compared with the average amount that the small-type sows varied from their average litter, 2.146 pigs per litter. The advantage in this case is in favor of the large type, since it is more desirable to have a small deviation; but, again, the difference is not great enough, either practically or theoretically, to be significant.

Swine production in Holland and its development in the last hundred years, H. M. KROON (*Die Schweinezucht in Holland und ihre Entwicklung in den Letzten 100 Jahren. Inaug. Diss., Univ. Bern, 1915, pp. 65, pls. 6*).—This dissertation treats of the various breeds of swine found in Holland, their distribution and improvement, methods of care and management, and the general status of the industry.

Experimental results in fattening poultry, M. A. JULL (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 7, pp. 49–52*).—In these experiments, conducted in Canada, three lots of birds received corn meal, oatmeal feed, and ground buckwheat as their respective grain rations. The ground feed was mixed with water, allowed to stand for at least twelve hours before feeding, and fed in a batter just thin enough to run out of a pail without difficulty. The birds were fed twice daily, the first feed being given early in the morning and the second one late in the afternoon. All food was removed from the feeding troughs as soon as the birds had satisfied their appetites.

It was found that less grain was required to produce 1 lb. gain in flesh when the birds were fed on corn meal than when fed on a ration of equal parts, by weight, of corn meal, oatmeal feed, and ground buckwheat, or when fed on a ration of pure oatmeal feed, also that the mixed ration was somewhat superior to the oatmeal ration in that respect. It was also shown that less grain was needed to produce 1 lb. gain in two weeks than in three weeks with the three rations, and that the extra profit obtained by feeding three weeks was not sufficient to warrant the practice, so that two weeks' feeding is to be preferred. While oatmeal feed gave the cheapest gains the mixed feed gave the largest profits, with oatmeal feed last in this respect.

The weights between live, dressed, and drawn poultry showed a gradual shrinkage, with much less loss of weight between the live and dressed birds than between the dressed and drawn birds. The difference in profit was also considerable, being in favor of dressing and showing an actual loss in drawing.

The profits derived from poultry fattening were 39.5 per cent on the investment.

Efficiency in roaster production, H. R. LEWIS (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 6, p. 48*).—Experiments conducted at the New Jersey Experiment Stations with Plymouth Rock and White Leghorn cockerels indicated that at nine months of age the Leghorns were matured and would soon become staggy, while the Rocks were in prime condition for slaughter. The average weight of the Rocks was 7.2 lbs., and of the Leghorns 3.8 lbs. The weight of the dressed carcass (weight after bleeding and picking and removing the heads, shanks, and offal) at the same age showed that in the case of the

Plymouth Rocks 75 per cent of the total carcass was available, while in the case of the Leghorns only 67.3 per cent was available. At this age the Barred Plymouth Rocks sold for 27 cts. a pound and the Leghorns for 21 cts.

Meat scrap in the laying ration, H. R. LEWIS (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 7, pp. 52, 53*).—In these experiments, conducted at the New Jersey Experiment Stations, pen 1 received 25 per cent of meat scrap in its dry mash and pen 2 received 10 per cent. Pen 1 laid 6,711 eggs during the first year, 4,207 the second, and 3,048 the third year, while pen 2 laid 4,639, 4,358, and 2,674 eggs during the respective years.

From the results of the experiments it is concluded that the higher percentage of meat scrap in the dry mash was justified, at least during the pullet year, as the profit above feed was $127.88 as against $75.60 in the pen receiving the low percentage of meat scrap. The first year of egg production in the first-mentioned pen was followed by a comparatively low production, whereas the production in the pen which had not been forced during the pullet year was only slightly decreased. The same results seemed to show during the third year, so that the general conclusion is drawn that high production during the pullet year is apt to be followed by decreased production in future years.

The mortality was practically uniform in each pen, the birds in both pens remaining in good condition in general throughout the period. The hatchability in each pen was practically uniform, and the size and weight of eggs in each pen were not noticeably different. Under systems of management where birds are kept for two laying years only, a higher percentage of meat scrap can undoubtedly be advised, as the increased production during the first year will more than balance the difference during the second year.

A study of egg production and some related factors, L. E. CARD (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 6, pp. 42–44*).—Records kept of laying hens at the Connecticut Storrs Experiment Station showed that a given pen will consume much more oyster shell when laying heavily than when laying less heavily or not at all. Using 32 pens of Single Comb White Leghorns a correlation table was worked out so that this relationship might be expressed mathematically. For this purpose the year was divided into thirteen four-week periods. The number of eggs laid by any given pen during any four-week period was used as the basis of distribution for one system of arrays, while the amount of oyster shell consumed during the same period was used as the basis for the other system of arrays. The coefficient of correlation as worked out from this table was 0.8724+0.0079, showing that a very close correlation exists between the factors under discussion. The same method, when applied to the heavy breeds, viz, Plymouth Rocks, Rhode Island Reds, and Wyandottes, taken collectively, showed a correlation factor of 0.8265+0.0096.

Similarly the relation between the amounts of grain and mash consumed and the corresponding egg production was worked out. In the case of the Leghorns there was a close correlation between the amount of mash consumed and the number of eggs laid, i. e., 0.7493+0.0157, while there was practically no correlation between the amount of hard grain consumed and the number of eggs laid, the correlation coefficient in this case being 0.0214—0.0353. The same general result was obtained in the case of the heavy breeds.

It appears from the study thus far conducted that the production during the summer months, except in the case of Wyandottes, is perhaps a better index of the yearly egg yield than is the winter production.

Value of egg shows, A. S. CHAPIN (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 7, pp. 53, 54*).—The methods and plans used in holding annual egg shows at Purdue University are outlined.

The poultry industry, its importance in agricultural development, H. M. Lamon (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 6, pp. 41, 42*).—An abstract of a paper presented before the Second Pan American Scientific Congress, giving a general review of the development of the poultry industry in the United States and other countries.

The management of the farm poultry flock, V. G. Aubry (*New Jersey Stas. Circ. 49 (1915), pp. 20*).—This circular deals with the housing, feeding, care, and management of the farm poultry flock.

The Flemish system of poultry rearing: Scientifically improved, Madame B. A. Jasper (*Country Life [London], 37 (1915), Nos. 956, pp. 577, 578, fig. 1; 957, pp. 635, 636; 958, pp. 672–674, figs. 2; 960, pp. 743–745, fig. 1; 962, pp. 838–840; 964, pp. 913–915; 38 (1915), Nos. 967, pp. 88, 89; 969, pp. 171–173; 971, p. 245; 973, pp. 294, 295; 975, pp. 367–369; 977, p. 437; 979, pp. 8*, 10*; 980, pp. 528–530*).—A very comprehensive treatise on the Flemish methods of breeding, incubating, brooding, housing, feeding, care, and management of poultry for meat and egg production.

American pheasant breeding and shooting, E. A. Quarles (*Wilmington, Del.: Hercules Powder Co., 1916, pp. 130, figs. 52*).—General methods of breeding, feeding, care, and management of pheasants are described.

DAIRY FARMING—DAIRYING.

[Convention of milk and butter producers at Washington, D. C., 1916] (*Amer. Food Jour., 11 (1916), No. 6, pp. 244–253*).—An account of the convention of milk and butter producers and other dairy interests held at Washington, D. C., May 5 and 6, 1916 (E. S. R., 35, p. 98).

On the change in the composition of the milk of cows, O. Allemann (*Milchw. Zentbl., 44 (1915), No. 8, pp. 122, 123*).—Analyses are given of colostrum milk and of milk at short intervals after parturition, showing the rapid changes that take place.

Effect of water in the ration on the composition of milk, W. F. Turner, R. H. Shaw, R. P. Norton, and P. A. Wright (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 4, pp. 167–178, fig. 1*).—In these studies four different methods of varying the water content of the ration were used: A full *v.* a limited allowance of drinking water; turnips *v.* a dry-roughage ration; wet *v.* dry beet pulp; and green *v.* dry crimson clover.

Certain individual cows at times produced milk having an abnormal fat content. This effect was apparently independent of the ration, as it occurred not only with the high water-content ration but with the dry as well.

A study of the data obtained in the four series, however, shows that the watery character of the ration has no effect upon the fat content of the milk. There was even less variation in the other milk constituents than in the fat. This indicates that rations of varying water content have no effect upon the composition of milk.

A bibliography of literature cited is given.

The influence of sickness on the composition and characteristics of cow's milk, R. Bergema (*Untersuchungen über den Einfluss einiger äusseren und inneren Krankheiten auf die Zusammensetzung und die Eigenschaften der Kuhmilch. Inaug. Diss., Univ. Bern, 1915, pp. 78*).—The specific gravity of milk was in general not noticeably altered by sickness of the animal. The chlorin content was in general high. The milk-sugar content often showed a decline, while the fat content was as a rule higher than normal. The diastase content showed an increase of this enzym, and the catalase content was very often high.

The composition of the milk of Egyptian animals, A. PAPPEL and G. HOGAN (*Cairo: Dept. Pub. Health, 1914, pp. 12*).—An analysis of Egyptian buffalo milk is given.

Effect of pasteurization on mold spores, C. THOM and S. H. AYERS (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 4, pp. 153–166, figs. 3*).—Studies were made with spores from pure cultures of a series of molds including several species of Penicillium, of Aspergillus, and of the mucors, with, in some experiments, the addition of *Oïdium* (*Oospora*) *lactis* and one strain of Fusarium. These sets of experiments were made to test the temperatures used in pasteurization by the holder process, those used in the flash process, and the effects of dry heat.

In the holder process of pasteurization, in which milk was heated to from 120° to 150° F. and maintained at these temperatures for 30 minutes, the *Mucor racemosus* group and *Rhizopus nigricans*, which are found more frequently than all others of the mucor group combined, were destroyed at 130°. The common green species of Penicillium are mostly dead at 130°; a few stand 135°, but two, one of them an undescribed soil organism, survived 140° for 30 minutes. Among species of Aspergillus, however, the strains of *A. flavus*, *A. fumigatus*, and *A. repens* all survived 145° for 30 minutes, and *A. repens* and *A. fumigatus* both survived 150°. These three species are always found in forage and feeding stuffs; hence, milk is more or less subject to contamination with them. *A. repens* grows very poorly in milk, however, and the examination of a great many cultures of milk and its products has shown that the actual development of *A. flavus* and *A. fumigatus* is comparatively rare. Pasteurization of milk at 145° may therefore be regarded as destroying mold spores completely enough to render them a negligible factor in the further changes found in the milk.

In the flash process of pasteurization, where milk was heated to from 145° to 175° for a period of 30 seconds, the spores of all the molds tested were destroyed with the exception of many spores of one form and occasional spores of three more forms. At 175° only occasional spores of two forms developed.

When the heating process was performed in dry air for a period of 30 seconds at 200°, 31 out of 42 forms of Penicillium and 7 out of 24 forms of Aspergillus were destroyed, but none of the cultures of the mucors. A temperature of 250° over a period of 30 minutes killed all the forms of *Penicillium* spp. tried, but left an occasional living spore in one species of Aspergillus and 3 out of 6 mucors.

Careful study of the cultures showed that the first effect of heating was to delay germination. At times heating to a degree just under the death point delayed germination almost the full length of the usual growing period of the species. There is frequently a survival of a few spores where a majority of the spores die. There may be, therefore, a difference of as much as 20° between the temperature at which an occasional culture is completely killed and that at which cultures of that species are uniformly killed. These results resemble those obtained in determining the thermal death point of bacteria.

Metallic flavor in dairy products, E. S. GUTHRIE (*New York Cornell Sta. Bul. 373 (1916), pp. 609–643*).—The results of these studies seemed to indicate that there may be a cause of metallic flavor other than direct contact of the dairy product with metal. In several instances it seemed to increase when the product was not in contact with metal.

Buttermilk in sterilized glass bottles developed the flavor in many cases. Of 241 samples of cream in sterilized glass bottles metallic flavor was produced in 79 by inoculation with metallic-flavored buttermilk; and of 157 samples of cream in sterilized glass bottles which were inoculated with individual bacteria 52 showed metallic flavor. It is concluded that the organism that causes metallic

flavor is a member or a strain of the *Bacterium lactis acidi* group. Metallic flavor may develop in cream of either good or poor flavor, and the indications are that enzyms may be a factor in its production.

It was found that high acid content is essential for the development of the flavor. It is possible that electrolytic action plays an important part in its production when the source is directly from metal. The flavor was most likely to appear during the hottest season. It may be that this was noticeable because the degree of acidity of the product is likely to be greater when the temperature is high.

A high fat content seemed necessary for the development of the flavor except in the case of buttermilk. Whenever the flavor was found in whole milk it was always near the surface, in the cream, and it was never observed in skim milk or cottage cheese. For some reason it was often found in buttermilk, but with this exception never in a dairy product low in fat content.

It is deemed difficult to explain why metallic flavor develops to a greater degree in buttermilk than in any other dairy product. It was thought that there might be a relation between the acids of the milk fat and the metallic flavor. Samples of butyric, caproic, caprylic, palmitic, stearic, and oleic acids were obtained, also propionic acid, which is lower in the fatty acid series, and succinic acid, which is a dibasic organic acid and may be found in dairy products. No sign of metallic flavor, however, could be detected in any of these acids.

The flavor appeared spasmodically. Often it could not be detected in butter for several weeks, and sometimes for many months, after which it suddenly appeared for perhaps a few days or possibly for several weeks. During all this time the same utensils were being used on the farms and in the creamery laboratories. Low temperatures often seemed to make the flavor more apparent.

Note on the neutralization of cream in butter manufacture, and the effect on the butter produced, A. A. Ramsay (*Dept. Agr. N. S. Wales, Sci. Bul. 16 (1915), pp. 10*).—A method of treating cream before manufacturing it into butter, known as "neutralizing and pasteurizing," is described. The term neutralizing, in conjunction with pasteurizing in the method of treating creams for the manufacture of butter, is used to indicate the reducing of the acidity, probably the excessive acidity, of the cream, not to the neutral point but to faint or slight acidity, say, to 0.2 per cent of acid expressed as lactic acid.

Sodium bicarbonate or, as an alternative, washing soda (crystallized sodium carbonate) is generally used on account of its cheapness and because the supply is plentiful. The result of the neutralization or partial neutralization is the formation of the sodium salt of the organic acids and the liberation of carbon dioxid. The carbon dioxid so formed is impeded in its passage through the cold mass of cream on account of the viscosity of the latter. This viscosity is lessened when the cream is heated to 170° F., as in pasteurizing, and the gas then escapes into the air. As it rises through the mass of cream it is claimed that it carries with it mechanically the volatile substances which give the cream an unpleasant smell or taste, as, for example, "food taint," and the heating to 170° assists in the removal of the gas and in the destruction of the micro-organisms present. The result is a product from which unpleasant odors and taints have been removed, and one which, if not absolutely sterile, is very nearly so. Into this mixture the pure culture of lactic bacilli, or "starter," is added, thus making an abundant growth of the lactic bacilli and producing good, clean lactic acid. The carbonates which may be used for the

purpose of either neutralizing or reducing the acidity of cream are sodium bicarbonate, washing soda, anhydrous sodium carbonate, and calcium carbonate.

Although the primary action of the alkaline carbonate or bicarbonate is simply to neutralize the free acids present, there will probably also be some action between the alkali added and the proteid matter present.

There appears to be reason to believe that in chemical composition butter made from neutralized and pasteurized cream should very closely approximate, if not coincide with, butter made from untreated cream. The skill, knowledge, and ability of the butter maker will be the principal factor which will control the amount of curd which will be present in the finished butter. Other things being equal, it appears justifiable, however, to expect somewhat less curd in butter made from neutralized than in that from untreated cream.

The butter industry in the United States, E. Wiest (*Columbia Univ. Studies Polit. Sci., 69 (1916), No. 2, pp. 264, figs. 12*).—This is a report of an economic study made of the butter and oleomargarine industries in the United States. The topics discussed are the manufacture of butter, organization for the production of butter, geographic distribution of butter-producing areas, organization for dairy education, grading and judging butter, history and development of the organization of the butter market, the present organization of the butter market, butter prices, adulteration and oleomargarine, and the oleomargarine law and its development.

Test to determine amount of yellow color in a product (*Hoard's Dairyman, 49 (1915), No. 11, p. 439*).—It is reported that the U. S. Bureau of Standards has found that the color of butter and oleomargarine can be satisfactorily graded by the ratio of its reflecting powers for blue and yellow light.

The yoghourt bacillus, F. Ducháček (*Biochem. Ztschr., 70 (1915), No. 3–4, pp. 269–293*).—The author conducted comparative experiments with the yoghourt bacillus as described by the workers at the Pasteur Institute and with the bacillus as described by Effront.

There was found to be a difference between these two types as regards the choice of the medium in which they develop. Bacillus *E* (Effront) developed exceedingly well in all the usual media, while *B. bulgaricus* was very exacting in this respect, requiring, besides a particular kind of sugar, the addition of lime for the neutralization of the acid, especially in artificial media. The two types differed as to their air requirements, *B. bulgaricus* growing in an anaerobic medium, while Bacillus *E* was distinctly aerobic. The two bacteria may also be distinguished by differences in the length of life, *B. bulgaricus* dying after three months and Bacillus *E* living for several years.

See also previous notes by Effront (E. S. R., 25, pp. 81, 609, 610) and Bertrand (E. S. R., 25, p. 609).

Studies on Lactobacillus fermentum, J. Smit (*Ztschr. Gärungsphysiol., 4 (1915), No. 4, pp. 273–299, figs. 3*).—This article reports a morphological study made of *L. fermentum.*

VETERINARY MEDICINE.

A handbook of veterinary medicine, H. J. Gobert (*Aide Mémoire du Vétérinaire Médecine, Chirurgie, Obstétrique, Formules, Police Sanitaire et Jurisprudence Commerciale. Paris: J. B. Baillière & Sons, 1915, pp. VIII+736, figs. 252*).—This is a ready reference work for the veterinarian.

Essentials of veterinary law, H. B. Hemenway (*Chicago: Amer. Jour. Vet. Med., 1916, pp. XIV+340*).—The several parts of this work pertain to (1) legal principles, (2) veterinary practice, (3) governmental control, and (4) animals generally.

Report of proceedings under the diseases of animals acts for the year 1914 (*Dept. Agr. and Tech. Instr. Ireland, Rpt. Diseases Anim., 1914, pp. 79*).—This is the usual report (E. S. R., 32, p. 778), dealing with the occurrence of infectious diseases of domestic animals, and giving statistical data, etc.

Report on operations of the veterinary sanitary service of Paris and the Department of the Seine during the years 1913 and 1914, H. MARTEL (*Rap. Opér. Serv. Vét. Sanit. Paris et Dept. Seine, 1913; 1914, pp. 167, figs. 21*).—These are the usual reports (E. S. R., 29, p. 880), giving detailed accounts of the work of the years 1913 and 1914.

The poisonous character of rose chafers, J. M. BATES (*Science, n. ser., 43 (1916), No. 1102, pp. 209, 210*).—The author records a serious loss among brook trout of Pine Creek, at Long Pine, Nebr., apparently due to feeding on rose chafers, which feed on and sometimes strip bare willows (*Salix fluviatilis*) that overhang the stream.

The significance of optimal culture media in testing disinfectants, K. SÜPFLE and A. DENGLER (*Arch. Hyg., 85 (1916), No. 4, pp. 189–197*).—The optimal media for obtaining an after-culture of staphylococci was found to be a 3 per cent glucose bouillon. For anthrax spores a 3 per cent glucose bouillon with the addition of 5 per cent horse or cattle serum yielded the most satisfactory results.

Antiphenol serum, JANINA WISZNIEWSKA (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 20, pp. 609–612*).—The author has isolated a substance from the products of intestinal putrefaction of protein which gives all the characteristic tests with phenolic reagents but which could not be identified as any known phenol derivative. The product is strongly alkaline and possesses some of the general characteristics of the leucomains. It is thermostable. When administered to animals with food it produced definite and characteristic sclerotic lesions of the arteries. When injected intravenously into a horse an antibody was produced which was employed as a therapeutic agent.

On the acetylene gas treatment in ringworm, sarcoptic, symbiotic, and dermatodectic manges, R. STOKOE (*Vet. Rec., 28 (1915), No. 1433, pp. 279, 280*).—The author has found that powdered calcium carbid applied to the affected part (which has been moistened following a thorough scrubbing) and allowed to effervesce from a minute to a minute and a half, will destroy the ringworm parasite. Carbid can also be used with success in destroying mange parasites.

On the refractive index of the serum in a guinea-chicken hybrid, R. PEARL and J. W. GOWEN (*Proc. Soc. Expt. Biol. and Med., 12 (1914), No. 2, p. 48; abs. in Maine Sta. Bul. 245 (1915), pp. 292, 293*).—In connection wtih some biochemical studies on heredity at the Maine Experiment Station it was observed in a guinea-chicken hybrid, produced from the mating of Cornish Indian Game and guinea fowl, that "there is a definite, characteristic, and permanent difference between the refractive index of the serum of the fowl and that of the guinea; and that in the hybrid the guinea parent is dominant in respect of the physicochemical constitution of the blood as measured by the refractive index."

The origin of the antibodies of the lymph, F. C. BECHT and A. B. LUCKHARDT (*Amer. Jour. Physiol., 40 (1916), No. 2, pp. 366–371, figs. 3*).—"The concentration of antibodies is greater in the serum than in the thoracic lymph, and greater in the thoracic lymph than in the neck lymph, not only in the actively immune animal but also in the passively immune animal; not only after equilibrium is established but at the time when active exchange is occurring. The source of the antibodies of the lymph is the blood by direct exchange

from that fluid. There is no evidence that antibodies originate from the tissues and are emptied into the lymph stream at the seat of formation."

Researches on anaphylaxis produced by diglycylglycin, E. ZUNTZ and MLLE. DIAKONOFF (*Biochem. Jour., 10 (1916), No. 1, pp. 160–168*).—Anaphylaxis was produced by the injection of diglycylglycin into rabbits repeated at intervals of seven days. Three injections were occasionally sufficient to produce this effect, but a greater number were preferable for producing clear and definite results. The typical symptons of anaphylactic shock, viz, fall of arterial pressure, increased respiration, and increased peristaltic action, were produced by these injections. A fall in the arterial pressure of more than 2 cm. of mercury was considered as an indication of anaphylactic shock. The intravenous injection of the peptid into a normal animal led to no effect on the normal respiratory rhythm.

The diglycylglycin also displayed some action on the coagulation of the blood. A study of the coagulability of the blood, however, did not serve as a criterion for determining anaphylactic shock in animals previously prepared by the subcutaneous injections of the peptid.

Remarks on the nature and significance of the so-called "infective granules" of protozoa, E. A. MINCHIN (*Ann. Inst. Pasteur, 29 (1915), No. 11, pp. 537–544, figs. 2*).—"This brief note does not bring forward any facts hitherto unknown, but attempts to compare and coordinate certain known facts with a view to demonstrate their essential similarity and homology. The conclusion reached is that the phrase 'infective granule' is misleading and erroneous, since the bodies so termed are true endogenous chromidial buds. Consequently the term 'granule-formation' should be replaced by 'endogenous bud formation' and the term 'granule shedding' by extrusion of buds or some similar phrase."

On the action of cholera virus in the immune animal organism, O. BAIL (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1916), No. 4, pp. 396–410*).—It has been shown that the union of cholera immune serum with the virus of the cholera vibrio in its various forms is not a permanent one, but that a cleavage takes place by which, on the one hand, serum-immune bodies are formed, as indicated by the earlier investigations of Pfeiffer, Friedberger, and Bail, and at the same time cholera virus is liberated which can be demonstrated either by complement fixation or animal inoculation. To this liberation of cholera virus is attributed the weak antitoxic action of anticholera sera. The necessity of the preparation of a serum which will permanently bind the cholera virus (endotoxin) is indicated.

[Foot-and-mouth disease], L. HOFFMANN (*Bekämpfung der Maul- und Klauenseuche durch Heilung der kranken Tiere, I and II; Sichere und rasche Bekämpfung und Vertilgung der an sich harmlosen Maul- und Klauenseuche, III; Heilung der Kranken und Vertilgung der Maul- und Klauenseuche nach meinem System, IV. Stuttgart: Stähle & Friedel, 1912, Nos. 1, pp. VIII+100, pl. 1, figs. 2; 2, pp. XVI+101–292, figs. 49; 1914, Nos. 3, pp. 293–408, pl. 1, figs. 4; 4, pp. 409–502*).—The first two parts of this work deal with the combat of foot-and-mouth disease through the curing of affected animals; part 3 with the control of the disease; and part 4 with the cure and eradication of the disease by the author's method.

[Poliomyelitis: Its possible occurrence in the lower animals and the relation of insects to its transmission] (*Ann. Rpt. Bd. Health Mass., 45 (1914), pp. 535–601. pl. 1*).—Several papers here presented include the following: Further Experiments in Poliomyelitis, by M. J. Rosenau (pp. 535–557), in continuation of those previously noted (E. S. R., 28, p. 160), which reports transmission experiments with the stable fly (*Stomoxys calcitrans*), largely in tabular form; Experiments to Determine If Paralyzed Domestic Animals and Those Associated

with Cases of Infantile Paralysis May Transmit This Disease, by C. Ten Broeck (pp. 558–577); and A Study of an Epidemic of Infantile Paralysis (Acute Epidemic Poliomyelitis) Occurring in the Southern Connecticut Valley District from November 1, 1911, to November 1, 1912, by J. V. W. Boyd (pp. 578–601), in which is given a brief account of a contemporary animal sickness among horses and an epidemic of paralysis among birds.

The experiments reported by Rosenau, carried on in 1912 and 1913, failed to corroborate the earlier experiments and give no evidence that the stable fly transmits infantile paralysis. In the experiments by Ten Broeck 48 animals were received and the material from 30 of these, including 4 rats, 7 fowls, 9 cats, 3 horses, 4 swine, 1 dog, and 2 cows, was injected into monkeys, but in no case did the monkeys inoculated show any signs of a paralysis or symptoms which would indicate that they were infected with poliomyelitis.

Present views in respect to modes and periods of infection in tuberculosis, M. P. Ravenel (*Jour. Amer. Med. Assoc., 66 (1916), No. 9, pp. 613–618*).—"The evidence at hand indicates that in the majority of cases the respiratory tract is the route of infection in tuberculosis. The alimentary tract is a frequent portal of entry for the tubercle bacillus. The tubercle bacillus is able to pass through the intact mucous membrane of the alimentary tract without producing a lesion at the point of entrance. This takes place most readily during the digestion of fats. The bacilli pass with the chyle through the lacteals and thoracic duct into the blood, which conveys them to the lungs, where they are retained largely by the filtering action of the tissues. Infection through the alimentary tract is especially frequent in children.

"Infancy and childhood are preeminently the periods of life when the individual is susceptible to tuberculous infection, and the majority of cases of infection occur during these early years. Any campaign against tuberculosis which leaves out of consideration the protection of children against infection will fail of success. Tuberculous infection in adult life occurs, but not so frequently or readily as generally believed. Tuberculous infection may occur at any age."

Experimental investigations on the determination of the smallest number of bacilli which will produce tuberculosis in the guinea pig; first communication, I. Thöni and A. C. Thaysen (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 77 (1916), No. 4, pp. 308–319*).—The authors were unable to confirm the findings of earlier investigators that so small a number as from 10 to 20 bacilli were sufficient to initiate the disease in the guinea pig. In one test series of 19 animals in which a highly virulent culture in doses of from 10 to 76 bacilli was used it was possible to establish a tuberculosis infection in only one animal after a period of 41 days. In a second series of 22 animals inoculated with doses of from 99 to 343 bacilli the results were entirely negative.

The technique for counting the number of micro-organisms used was the India-ink staining procedure of Burri.

The tubercle bacillus and arsenic, Charpentier (*Ann. Inst. Pasteur, 29 (1915), No. 9, pp. 443–458*).—In the investigation it was demonstrated that an active growth of the tubercle bacillus took place in a bouillon containing sodium arsenate or atoxyl. The growth was less active in the presence of sodium methyl arsenate and difficult in the presence of sodium cacodylate. The organisms absorbed arsenic from solutions of sodium arsenate and atoxyl. The virulence of the organisms was not changed by such treatment, since they produced an active infection when injected into guinea pigs. It is indicated that the presence of the arsenic in the bacilli probably increases their resistance to destructive agencies. Similar results were obtained with other organisms, viz, Aspergillus, *Bacillus coli, B. subtilis,* and yeasts. Injections of so-

dium cacodylate did not modify the course of an infection in guinea pigs which had been previously initiated by inoculation of virulent organisms, although the treatment was begun at once.

Clinical observations on coccidiosis in cattle and carabaos, C. H. SCHULTZ (*Philippine Agr. Rev.* [*English Ed.*], *8* (*1915*), *No. 2, pp. 115–134*).—This paper relates to studies accounts of which have been previously noted (E. S. R., 35, p. 76).

Contributions on ox warbles (*Mitt. Ausschusses Bekämpf. Dasselplage, 1912, Nos. 1, pp. 28; 2, pp. 16, pls. 4; 3, pp. 37, figs. 10; 4, pp. 26, fig. 1; 1913, No. 5, pp. 39, pls. 4, figs. 2; 1914, No. 6, pp. 31*).—These several contributions relating to ox warbles are as follows: (1) Ox Warble Injury and the Removal of Ox Warbles, by R. Krause; (2) Ox Warble Flies, by H. Gläser; (3) Investigations of Hypoderma Larvæ, by Peter, Ox Warble Removal, by Schöttler, and Warble Flies: The Egg and Oviposition of the Large Warble Fly (*Hypoderma bovis*), by H. Gläser, previously noted (E. S. R., 29, p. 761); (4) Warble Flies: Observations on the Life History of the Large Warble Fly (*H. bovis*) and Rearing Experiments, by H. Gläser, previously noted (E. S. R., 29, p. 761); (5) Warble Flies: New Investigations of the Life History of Both Ox Warble Flies, by H. Gläser; and (6) Warble Removal Experiments in the Neuhaus an-der-Oste District in April, 1913 (pp. 3–16), and Warble Removal in Oldenburg in 1913 (pp. 17–25), by Schöttler and H. Gläser, and Experiments Which Show That the Warble Larvæ Cause a Loss of Flesh of Cattle, by H. Gläser (pp. 26–31).

Bacteria in the intestinal tract of calves, H. KÜTHE (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 76* (*1915*), *No. 6, pp. 409–434, figs. 10; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 11, pp. 1500, 1501*).—The author finds three forms to be constantly present in the intestinal tract of suckling calves, namely, *Bacillus acidophilus polymorphus*, *B. coli*, and *B. mesentericus*.

An extensive bibliography relating to the subject is included.

Hog cholera and its prevention, R. R. BIRCH (*Cornell Vet., 6* (*1916*), *No. 2, pp. 90–111, pls. 11*).—This article discusses the subject of hog cholera in general, the preparation of serum at the New York State Veterinary College, serum treatment, and the use of serum in the field.

Hog cholera in Cuba, B. M. BOLTON (*Estac. Expt. Agron. Cuba Bol. 26* (*1915*), *pp. 22*).—A general account of "Pintadilla" or hog cholera and preventive measures.

Poisoning by Lathyrus sativus, SZCZEPANSKI (*Abs. in Vet. Rec., 27* (*1915*), *No. 1392, p. 478*).—A report upon the poisoning of two horses by *L. sativus* present in oats and peas with which they were fed. The feeding of the peas was stopped at once upon discovery of the cause but nevertheless two weeks later all the other horses in the stable, of which there were ten, developed toxic symptoms. Two horses are said to have died from the poisoning.

Contagious abortion in mares, G. SOMENZI (*Clin. Vet.* [*Milan*], *Rass. Pol. Sanit. e Ig., 38* (*1915*), *No. 5, pp. 206, 207; abs. in Vet. Rec., 27* (*1915*), *No. 1399, p. 565*).—A report of two outbreaks of this disease in which a bacillus belonging to the paratyphoid B group was isolated at the Milan Station for Infectious Diseases.

Arsenical preparations in the treatment of equine pectoral influenza, REIMERS (*Berlin. Tierärztl. Wchnschr., 31* (*1915*), *No. 37, pp. 433–436; abs. in Clin. Vet.* [*Milan*], *Rass. Pol. Sanit. e Ig., 39* (*1916*), *No. 1, p. 14; Vet. Rec., 28* (*1916*), *No. 1443, p. 400*).—Of 83 cases treated with neosalvarsan, some of which were seriously affected, but one succumbed during treatment and in this case the treatment was commenced too late. The neosalvarsan was used in doses

of 4.5 and of 3 gm., which were mixed respectively with 120 gm. and with 100 gm. of a sterile 0.4 per cent solution of sodium chlorid and administered by intraveneous injection. No abnormal lesions were observed to have been caused by the injection. Other similar preparations, including atoxyl, plasmarsin, and arsinosolvin, did not give as good results. It is concluded that neosalvarsan is the best remedy for pectoral influenza and that it gives 100 per cent of recoveries when used in time.

Epitheliosis infectiosa avium. Contagious epithelioma. Chicken pox. Diptheria. Roup. Canker, O. V. BRUMLEY and J. H. SNOOK (*Vet. Alumni Quart.* [*Ohio State Univ.*], *3* (*1916*), *No. 3, pp. 81–98*).—The authors' bacteriological experiments and the satisfactory results obtained from vaccination led them to conclude that they have been dealing with a single disease. The confusion in names has led them to designate the affection as infectious epitheliosis of birds (epitheliosis infectiosa avium).

"Work extending over a period of six years convinces us that typical infectious epitheliosis is due to a combination of two factors: (a) A filterable virus; (b) secondary invading organisms which vary in kind but of which the so-called *Bacillus diphtheriæ columbarum* of Loeffler appears to be the most important. The filterable virus is the necessary primary invader which lowers the bird's resistance and thus prepares the tissues for the invasion by the secondary organisms. Neither factor alone will cause the typical disease.

"The excellent results derived from the use of a vaccine made from the secondary organisms, both in prevention and treatment, are due to controlling the secondary infections which cause the serious complications. If these are controlled infection due to the primary virus is mild and soon disappears. (There is a remote possibility that the filterable virus is contained in the vaccine. We have no evidence that this is or is not the case. The presence of the virus in the vaccine would indicate its growth with the other organisms on the cultures. This would be contrary to our present knowledge of filterable viruses. This point will be investigated.)

"The therapeutic dose, as indicated by the large number of birds treated, is 1 cc. for the average adult bird. Younger and smaller birds receive a lesser amount. The immunizing dose found most satisfactory is 1 cc. No bad results have followed when larger doses have been administered. Reports received to date indicate that vaccination is equally efficacious in the treatment of infectious epitheliosis in turkeys."

Spontaneous and experimental leukemia of the fowl, H. C. SCHMEISSER (*Jour. Expt. Med.*, *22* (*1915*), *No. 6, pp. 820–838*).—"The spontaneous occurrence of myeloid leukemia of the fowl is confirmed. Myeloid leukemia of the fowl is transmissible by intravenous or intraperitoneal injection of an organic emulsion.

A report upon an outbreak of fowl typhoid, W. J. TAYLOR (*Jour. Amer. Vet. Med. Assoc.*, *49* (*1916*), *No. 1, pp. 35–49*).—This is a report of investigations of fowl typhoid during the course of an outbreak in California which led to the following conclusions:

"Fowl typhoid is a specific disease of fowls caused by *Bacterium sanguinarium* occurring sporadically and causing heavy losses among affected flocks, and unless properly investigated may easily be mistaken for fowl cholera because of its high mortality. The specific morbid conditions consist of an enlarged liver containing necrotic areas, an enlarged spleen, and a general anemic condition of the serous and mucous membranes, together with a marked increase in leucocytes and a corresponding decrease of the red cell content of the blood. The increase in leucocytes seems to be confined to the polymorphonuclear variety. Fat, well-conditioned adult fowls are more susceptible than young, nearly mature growing birds.

"Birds may contract the disease by the ingestion of pure cultures of *B. sanguinarium*. Birds fed upon the offal of other birds dead of this disease show a mild nonfatal form of the disease tending to recovery. There is evidence that recovery from this mild form produces more or less of an immunity. Further investigation upon this point is needed.

"The power of some of the red corpuscles of the affected fowls to take the violet stain when the blood is diluted in Toisson's fluid is especially noticeable in this disease. While the lesions produced in fowls which are infected with *B. sanguinarium* resemble in many respects those produced by *B. pullorum*, and although there is a still closer resemblance in the biological characters of the two organisms, there is enough difference to warrant the conclusion that they are distinctly different diseases."

The rearing of turkeys with special reference to the blackhead disease, P. B. HADLEY (*R. I. State Col. Ext. Bul. 2, n. ser.* (*1916*), *pp. 20, figs. 2*).—A general discussion of the subject in which is pointed out the importance of controlling by suitable methods of feeding the development of parasites in the intestinal canal and of preventing the invasion of the tissues.

Diseases of poultry, W. CHENEVARD (*Maladies des Volailles. Paris: J. B. Baillière & Sons, 1916, pp. 90, figs. 27*).—A small handbook.

RURAL ENGINEERING.

Fourteenth annual report of the Reclamation Service, 1914–15 (*U. S. House Representatives, 64th Cong., 1st Sess., Doc. 38, pp. VII+521*).—This report relates in particular to work completed and in progress during the fiscal year ended June 30, 1915, but contains also information in regard to previous operations to show the methods, progress, and results of reclamation work.

Classification of expenditures for irrigation work, F. H. NEWELL (*Engin. and Contract., 45* (*1916*), *No. 9, pp. 201–204*).—Expenditures for operation and maintenance of irrigation systems are classified and discussed under five general heads, as, (1) development, (2) carriage, (3) distribution, (4) drainage and flood protection, and (5) structure depreciation. Ways of obtaining efficiency and economy in recording and classifying expenditures on such a basis are pointed out.

Irrigation districts in California, 1887–1915, F. ADAMS (*Cal. Dept. Engin. Bul. 2* (*1916*), *pp. 151, pls. 15*).—This report is based on data gathered from time to time during the past 15 years in cooperation with the U. S. Department of Agriculture. Its main divisions deal with the original Wright Act of 1887, the irrigation district act of 1897, irrigation district legislation since the act of 1897, the status of California districts July 1, 1915, and court decisions affecting California irrigation districts. Appendixes are included giving (1) a statistical list of California irrigation districts organized under the Wright Act, (2) a list of irrigation districts proposed under that act for which organization was not completed, (3) a list of irrigation district cases affecting California irrigation districts and subjects dealt with in decisions, and (4) an outline of the California irrigation district act of 1897 as amended to 1915.

Water resources of Illinois, A. H. HORTON (*Springfield, Ill.: Rivers and Lakes Com., 1914, pp. VIII+400, pls. 20, fig. 1*).—This report, prepared in cooperation with the U. S. Geological Survey, contains data on stream flow, precipitation, evaporation, drainage, and undeveloped water power and water storage in Illinois. It includes stream profiles, rainfall records, and maps prepared by the Weather Bureau of the U. S. Department of Agriculture; a gazetteer of Illinois streams; and an appendix, by G. B. Hills, on developed water power and drainage districts of Illinois.

Report on Pit River basin, E. G. Hopson and O. W. Peterson (*Cal. Cooper. Work, Dept. Int. U. S. Reclamation Serv., 1915, Apr., pp. 140, pls. 19*).—This report deals with investigations made in 1914 and 1915 by the U. S. Reclamation Service and the State of California, acting in cooperation, of run-off, storage possibilities, lands, irrigable areas, present uses of water, and power development possibilities of an area including 6,000 square miles in northeastern California which consists of both mountainous and plateau country.

Among the conclusions from this investigation are that in the Pit River basin there are about 180,000 acres of potentially fertile, irrigable land, of which about 40 per cent is now fully or partially irrigated. Of the areas now irrigated only an insignificant proportion is well developed agriculturally, due in large part to unregulated water supplies and to unsatisfactory drainage conditions. Lands in Fall River Valley can be advantageously irrigated by pumping, the supply being practically inexhaustible, while lands adjacent to and in the vicinity of Hat Creek, that are not yet irrigated, can be readily irrigated by direct diversion without storage. Irrigation development in the Pit River basin will not seriously interfere with future power development in or below the basin, or with the navigability of the river. Floods in the Sacramento Valley can not be controlled by storage in the Pit River basin.

Silver Lake project: Irrigation and drainage, J. T. Whistler and J. H. Lewis (*Oreg. Cooper. Work. Dept. Int. U. S. Reclamation Serv., 1915, Oct., pp. 179, pls. 27*).—This report, prepared in cooperation with the State of Oregon, deals with the irrigation and water-power possibilities of the Silver Lake region, Lake County, Oreg., together with the reclamation of Silver Lake and Paulina Marsh by drainage and pumping.

"The features to which this report has special reference are: (1) The irrigation of lands about Silver Lake and Fort Rock by storage of about 60,000 acre-feet of water at Thompson Valley, into which diversion canals from Sycan River and Long and Coyote creeks will divert the spring run-off from these streams. . . . (2) The reclamation and irrigation of about 9,000 acres of Paulina Marsh by storage on lower Buck Creek at the Emory reservoir site and a drainage canal through the marsh to Silver Lake . . . (3) The possible development of summer power on Silver Creek from Thompson Valley storage for use in pumping to reclaim part of Silver Lake bed; in pumping from ground water to supply additional lands in Fort Rock Valley; and in pumping from Ana River Springs for the irrigation of about 20,000 acres of land in Summer Lake Valley. . . .

"Conditions for the development of the proposed project to irrigate 48,600 acres are exceptionally favorable to development by stages. . . .

"Considerations of available water supply, extent of irrigable lands, and possibilities of irrigation by economic use of water, together with careful cultivation of land and distribution by rotation, have led to adopting for the proposed project a water duty of 1 acre-foot delivered per acre of irrigable land.

"The soils over the larger portion of the project appear to be those of old lake beds and terraces. They are generally free working loams that readily mulch, yet with fine enough material in the subsoils to have good water retaining capacities. Chemical analyses show them to be reasonably fertile in phosphorus and potash and to have medium nitrogen content. The alkali content is comparatively small."

It is estimated that the mean run-off for lower Silver Creek for the past 12 years is 40,400 acre-feet.

Irrigation experiments, G. K. Kelkar (*Dept. Agr. Bombay, Ann. Rpt. Expt. Work Surat Agr. Sta., 1913–14, pp. 36–38*).—In irrigation experiments with

cotton, sorghum, and tur (pigeon peas), the irrigated plats showed superiority in yield over nonirrigated plats in a dry year, but the irrigation did not "financially show any benefit from the economic standpoint."

Venturi meter developed for accurate measurement of irrigation water, A. A. Wood (*Engin. Rec., 73 (1916), No. 13, pp. 411–413, figs. 3*).—A recording device, applying the Venturi meter principle, is described which is designed to establish rates on an equitable basis for water users. It is thought that by its use the flat-rate system of charges may be eliminated.

Swamp-land drainage with special reference to Minnesota, B. Palmer (*Univ. Minn., Studies Soc. Sci., No. 5 (1915), pp. 138*).—This report contains a brief statement relative to the drainage work in foreign countries, the extent of land needing drainage in the United States, drainage laws and development of drainage legislation in Minnesota, drainage procedure, and the extent of swamp-land reclamation in Minnesota. As an appendix is given the drainage statutes of various States and references to drainage cases in the Minnesota Supreme Court. A statistical table showing the land in need of drainage, the area drained, and the cost and average net profit per acre as result of drainage, together with a brief bibliography, is included.

Land bedding as a method of drainage in the Gulf coast region of Texas, E. W. Gruss (*Agr. and Mech. Col. Tex. Ext. Serv. Bul. B–11 (1915), pp. 6*).—This method is briefly described.

Tile drainage by day labor and by the rod (*Engin. News, 75 (1916), No. 10, pp. 450–452, figs. 5*).—This article describes a land drainage system on the Mississippi River built for three landowners jointly, the work being done by day labor under the direction of the engineer.

Experiments with the automatic water finder in the trap region of western India, H. H. Mann (*Dept. Agr. Bombay Bul. 72 (1915), pp. 17, pls. 3*).—The results of the experience of others along this line are noted and tests are reported of a so-called automatic water finder.

This finder consists of a wooden case divided into two chambers, the lower containing coils of wire wound on a bobbin, and the upper, at the center, a pivot on which rests a light magnetic needle, which, by its movements, is supposed to detect underground streams. With the instrument are provided a tripod stand and a table on which the instrument is to be placed while taking an observation. On the table there is a white line which is always to be directed toward the magnetic north while using the instrument. "It is obvious that what the instrument detects is not the stream of water, but some electric condition which accompanies that stream."

The results of a large number of tests at different places indicated that "where a stream of water is known to exist the indications of the instrument are by no means constant and the deflection of the needle may vary in direction as well as in amount."

". . . It would seem, however, sufficiently proved that under the conditions which prevail in the trap areas of western India, where underground water occurs in well-defined streams flowing in rock fissures, sometimes under little or no pressure and sometimes under considerable pressure, the automatic water finder can be used with advantage in locating streams of water which can be tapped either by well digging or by boring."

The conditions affecting the accuracy of the instrument and the precautions to be observed in its use are explained.

Investigation of the pollution and sanitary conditions of the Potomac watershed, H. S. Cumming et al. (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 104 (1916), pp. 231, pls. 50*).—This report is the result of an investigation of the pollution of the Potomac River and its tributaries begun June 2, 1913, and

continued until May 31, 1914. The investigation included a sanitary survey of the Potomac River watershed and laboratory studies of the water, mud, plankton, and shellfish. The sanitary survey included investigations as to the number of persons on the watershed, the prevalence and distribution of typhoid fever, the water supplies, sewage-disposal systems, and character and amounts of trade wastes.

It was found "that at no point above Washington is the water of the Potomac River safe for use as a public water supply without reasonable treatment. . . . At no time was the condition over and about the Washington sewer outlet such as to constitute a nuisance. Even during the period of lowest stream flow and highest temperature the river in the area of heaviest pollution . . . has at all times sufficient oxygen available for the sewage now discharged into the river and enough to take care of the sewage which will probably be added for several years to come. In addition to the dissolved oxygen contained in the water of the river as it flows from the Great Falls, the great areas of flats on each side of the river for many miles act as oxygen generators. The amount of oxygen given off, depending in part upon the condition of plant life, turbidity, and sunshine, is, therefore, greatest during the summer when there is the most need for it. In addition to releasing enormous volumes of oxygen these flats are breeding places for plankton forms, which themselves materially assist by biological processes in the breaking down of sewage and the consequent purification of the river. . . . Few intestinal organisms from above reach Maryland Point, and these disappear in the stretch of 10 miles between that point and Popes Creek, at which section evidence of pollution from the upper river has disappeared.

"In an examination of oysters from all the beds in the whole river and its tributaries, extending over an entire season, no dangerously polluted oysters were found in the Potomac River proper. . . . Analysis of the results obtained during the year in the examination of shellfish and of water taken from over the oyster beds shows that the periods of highest *Bacillus coli* count in the two were not coincident." . . .

Tests of bacteriological methods are also reported in some detail. As a result of these studies it is recommended that the lactose bile presumptive test be not used, because of the unreliable results obtained therefrom; and that the use of lactose broth fermentation tubes, with confirmation on endo medium, be adopted as a routine procedure in the examination of water and shellfish for the determination of the presence of *B. coli*.

Analyses of waters, J. C. Brunnich (*Ann. Rpt. Dept. Agr. and Stock [Queensland], 1914–15, pp. 50–52*).—Analyses of 65 samples of Queensland waters are reported and discussed with reference to their use for domestic, stock-watering, and irrigation purposes.

Results of first year's experiments with small sewage treatment plants by U. S. Public Health Service, L. C. Frank (*Engin. and Contract., 45 (1916), No. 18, pp. 420–422*).—The results of experiments with the Imhoff tank and sand bed combination for use on a small scale are reported, from which the following conclusions are drawn:

"It is possible by means of a five-hour mean detention period in a properly designed Imhoff tank to remove from the raw sewage of small communities 98 per cent of the settleable solids without producing a nuisance. A mean detention period of six hours, based on the average daily flow, will not cause the sewage to become septic or foul smelling if it is fresh when it enters the tank. The accumulation of a disagreeable mass of grease and fecal matters in the first compartment of the settling chamber may be prevented by the introduction of a horizontal coarse mesh screen at the water level of this chamber. The screen

keeps the floating matters submerged and apparently results in all fecal matter sooner or later becoming water-logged and sinking through the slot into the sludge chamber. It is too soon to state with conviction the amount of digested sludge that may be expected from small-scale tanks, but one tank indicates an apparent accumulation of 2.6 cu. ft. per year per person and another tank 4 cu. ft. The only period during which the Imhoff tanks required daily attention was the foaming period, which lasted about ten days, and during which time some of the foam had to be removed and buried. At all other times attention once a month at the most was ample. Since the foaming period has been passed the scum formation has been slight.

"The decomposed sludge obtained from the small-scale Imhoff tanks resembled that obtained in large tanks except that it had a much higher moisture content. This may perhaps be explained by the shallowness of the sludge layer. A 15-in. sand bed dosed with settled sewage at a net rate of 190,000 gal. per acre per day during the second summer reduced an average oxygen demand of 63 parts per million to 12 parts per million (24 hours, 20° C.). This is probably ample purification for many cases, but insufficient for others. The sand bed required very little attention during the summer months, but what would seem to be a prohibitive amount of attention during the winter months, even though covered with a tongue-and-groove wooden cover. No nuisance was produced during the summer months by the dosing of the uncovered sand bed with the Imhoff tank effluent. The growth of weeds on the sand surface did not seem to have an unfavorable effect upon the operation of the sand bed."

A practical process for the sterilization and utilization of polluted water in the field, ROLLAND (*Jour. Pharm. et Chim., 7. ser., 12 (1915), No. 6, pp. 179–182, fig. 1; abs. in Chem. Abs., 10 (1916), No. 2, p. 236*).—Water in a barrel is treated with a sufficient excess of calcium hypochlorite of known strength to impart a distinct chlorin taste. It is next passed into a large funnel containing absorbent cotton, and then upon a perforated disk with alternate layers of finely powdered charcoal, fine sand, powdered charcoal, coarse sand, wood charcoal, crushed stone, and straw to distribute the water.

Dams and weirs, W. G. BLIGH (*Chicago: Amer. Tech. Soc., 1915, pp. [VIII]+206, figs. 124*).—This is an analytical and practical treatise on gravity dams and weirs, arch and buttress dams, and submerged weirs and barrages. It contains the following chapters: Gravity dams, design of dams, unusually high dams, notable existing dams, special foundations, gravity overfall dams or weirs, arched dams, multiple arch or hollow arch buttress dams, hollow slab buttress dams, submerged weirs founded on sand, and open dams or barrages.

Good roads of Monroe County, New York, 1915, J. Y. McCLINTOCK (*Rochester, N. Y.: Co. Supt. Highways, 1915, pp. 48, pl. 1, figs. 86*).—This is a report of the county superintendent of highways for 1915, giving tabulated statements of expenditures for highway purposes during the year and calling attention to the more important features of the work.

Fourteenth annual report of the state board of public roads of the State of Rhode Island (*Ann. Rpt. Bd. Pub. Roads R. I., 14 (1916), pp. 60*).—This is a report of expenditures on road and bridge work in the State for 1915.

Surface oiling of earth roads, B. H. PIEPMEIER (*Ill. Highway Dept. Bul. 11 (1915), pp. 28, figs. 26; Sci. Amer. Sup., 81 (1916), No. 2102, pp. 250, 251*).—"It is the purpose of this publication to present as many facts concerning the use of oil as it is possible to secure at this time, also to describe what is shown by experience to be the best method of preparing the road and applying the oil, together with a few suggestions that may be of some assistance to the contractor or individual who has such work under consideration.

"Roads should not be oiled until they have a permanently established grade. . . . Low, flat, undrained roads should not be oiled until proper drainage has been attended to. . . . Roads that have a preponderance of heavy hauling should not be selected for oiling. . . . The main purpose of oiling earth roads is to suppress the dust and aid in maintaining a smooth and waterproof surface. . . .

"It is very important that the road surface be oiled when it is smooth, free from dust, and in a condition to absorb the oil. . . . Best results may be expected when the road is reasonably dry for about 2 in. on the surface. . . . The oil should be applied at the rate of from $\frac{1}{4}$ to $\frac{1}{2}$ gal. per square yard of surface. If the road has never been oiled, or if more than a season has elapsed since a previous oiling . . . about $\frac{1}{2}$ gal. per square yard will be required. If the road or street has been oiled regularly, from $\frac{1}{4}$ to $\frac{1}{3}$ gal. per square yard will usually be satisfactory. . . . After a road has been oiled for several years, one light application each year may be sufficient, or at least equal in results to two applications per year on a new oiled road. . . .

"The uniform distribution of the material is one of the essential requirements for success. . . . Better results can be secured from sanding the road slightly after either hot or cold oil has been applied. . . . A hot oil application should be followed with a light dressing of sand . . . at a rate of 1 cu. yd. to each 100 to 150 sq. yds. of road surface. . . . It seems essential that careful analysis be made of all road oils before using and that preference be given to the natural and semiasphaltic products over the paraffin oils."

Other general information regarding the oiling of sand and gravel and macadam roads is given.

Popular handbook for cement and concrete users, M. H. Lewis and A. H. Chandler (*New York: The Norman W. Henley Publishing Co., 1911, pp. IX+430, figs. 126*).—This is a comprehensive and popular treatise on the principles involved and the methods employed in the design and construction of modern concrete work, covering both plain and reinforced concrete.

It contains the following chapters: Kinds of cement and how they are made; properties, testing, and requirements of hydraulic cements; concrete and its properties; sand, broken stone, and gravel for concrete; how to proportion the materials; how to mix and place concrete; forms for concrete construction; the architectural and artistic possibilities of concrete; concrete residences; mortars, plasters, and stuccos and how to use them; the artistic treatment of concrete surfaces; concrete building blocks; the making of ornamental concrete; concrete pipes, fence posts, etc.; essential features and advantages of reinforced concrete; how to design reinforced concrete beams, slabs, and columns; explanation of the theory of the design of reinforced concrete beams and slabs; systems of reinforcement employed; reinforced concrete in factory and general building construction; concrete in foundation work; concrete retaining walls, abutments, and bulkheads; concrete arches and arched bridges; concrete beam and girder bridges; concrete in sewerage and drainage works; concrete tanks, dams, and reservoirs; concrete sidewalks, curbs, and pavements; concrete in railroad construction; the utility of concrete on the farm; the waterproofing of concrete structures; grout or "liquid concrete" and its uses; inspection of concrete work, a summary of essential rules and principles of construction for securing good concrete work; and cost of concrete work.

Concrete on the farm and in the shop, H. C. Campbell (*New York: The Norman W. Henley Publishing Co., 1916, pp. 149, figs. 51*).—This is a popular treatise on the fundamental principles of concrete construction with particular reference to farm structures. It contains the following chapters: Gen-

eral summary of concrete principles; aggregates; principles of proportioning; mixing concrete; placing concrete; protection after placing; cold weather concreting; recommended mixtures; forms; concreting tools; foundations; principles of reinforcing; materials for reinforcing; walls and fences; posts; rubble concrete; tanks and troughs; cisterns; form removal; hog wallow; manure pit; repairs of leaks in tanks, etc.; hotbeds; roofs for small buildings; pavements, feeding floors, and walks; steps; and well curbs and platforms.

Tests of three large-sized reinforced-concrete slabs under concentrated loading, A. T. GOLDBECK and E. B. SMITH (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 6, pp. 205–234, pl. 1, figs. 28*).—Tests of three large reinforced-concrete slabs to determine their effective widths under concentrated loading, as defined by McCormick (E. S. R., 33, p. 487), and "to demonstrate the application of the theory of narrow rectangular beams to the design of wide slabs supported at two ends and subjected to concentrated loads," are reported All three slabs were 32 ft. wide, of 16 ft. span, and reinforced but not transversely, made of machine-mixed 1:2:4 concrete. A complete description of the slabs is given in the following table:

Description of reinforced-concrete slabs used in tests.

Thickness.		Reinforcing.			Modulus of elasticity of concrete.	Central breaking load of slab.
Total.	Effective.	Size.	Spacing.	Per cent.		
Inches.	*Inches.*	*Inches.*	*Inches.*			*Pounds.*
12	10½	¾ (plain square).	10.5	0.75	2,900,000	119,000
10	8½	¾ (plain square).	8.87	.75	4,000,000	80,000
7	[illegible]	½ (plain square).	5.56	.75	3,000,000	40,000

The data of results are graphically reported.

It was found that "with an increase in load the effective width seems to increase slightly. Values for effective width were obtained from the steel deformations as well as from the concrete deformations, but . . . the concrete deformations gave the most conservative widths. . . . As the thickness increases the effective width decreases, varying from 109 per cent of the span length for a 6-in. slab to 75 per cent of the span for a 10.5-in. slab. The least value for effective width shown by these tests is roughly, then, about 0.7 of the span length. . . . It would seem that under extremely heavy loads, requiring very thick slabs, the effective width might be decreased as low, possibly, as 0.6 of the span length. However, 0.7 of the span will always be safe, and in general is a sufficiently conservative figure to use."

The effective widths of the spans tested are given in the following table:

Effective widths of reinforced-concrete slabs, 16-ft. span by 32 ft. wide, for center loading.

Center load.	Slab (10½ in. effective thickness).	Slab (8½ in. effective thickness).	Slab (6 in. effective thickness).
Pounds.			
15,000	....	11.4 ft.=71.6 per cent of span.	12.7 ft.=79.5 per cent of span.
20,000	11.6 ft.=72.3 per cent of span..	13.0 ft.=81.2 per cent of span.	17.5 ft.=109.3 per cent of span.
25,000	11.5 ft.=71.9 per cent of span..	12.9 ft.=81.1 per cent of span.	....
32,500	12.1 ft.=75.7 per cent of span..	....	....
35,000	....	14.5 ft.=90.7 per cent of span.	....
Safe load...	12.1 ft.—75.7 per cent of span..	12.9 ft.=81.1 per cent of span.	17.5 ft.=109.3 per cent of span.

"The usual rectangular-beam design formulas may be applied to the design of slabs by merely substituting for b its value as determined by these investigations, $b=0.7L$. The corresponding formulas then become—

For rectangular beams.	For slabs under central concentrated loads.
(1) $M_c=\frac{1}{2}f_ckjbd^2$.	$M_c=\frac{1}{2}f_ckj\frac{7}{10}Ld^2$.
(2) $M_s=pf_sjbd^2$.	$M_s=pf_sj\frac{7}{10}Ld^2$.
(3) $p=\frac{a_s}{bd}$.	$p=\frac{10a_s}{7Ld}$.
(4) $p=\frac{\frac{1}{2}}{\frac{f_s}{f_c}\left(\frac{f_s}{nf_c}+1\right)}$.	$p=\frac{\frac{1}{2}}{\frac{f_s}{f_c}\left(\frac{f_s}{nf_c}+1\right)}$.
(5) $k=\sqrt{2pn+(pn)^2}-pn$.	$k=\sqrt{2pn+(pn)^2}-pn$.

"It is interesting to note that in substituting for M_c and M_s in formulas 1 and 2 their value $\frac{PL}{4}$ the L's cancel, showing that the safe load-carrying capacity of the slab is independent of the span; thus—

$$1 \text{ becomes } \frac{PL}{4}=\tfrac{1}{2}f_ckj\frac{7}{10}Ld^2 \quad \text{or} \quad P=\frac{7}{5}f_ckjd^2.$$

$$2 \text{ becomes } \frac{PL}{4}=pf_sj\frac{7}{10}Ld^2 \quad \text{or} \quad P=p\frac{14}{5}f_sjd^2.$$

"The above investigations were made on slabs the width of which was twice the span length, so that the stress at the extreme edges was very small. The conclusions must therefore be applied to such cases only. When the ratio of width of slab to span length is less than 2, these conclusions may or may not apply, and additional investigations are now being made to determine the proper value of effective width to use under such conditions."

The action of Portland cement mortar in different salt solutions, V. Rodt (*Mitt. K. Materialprüfungsamt Berlin-Lichterfelde West, 33 (1915), No. 3–4, pp. 229–240*).—Tests to determine the influence of solutions of sodium, calcium, and magnesium chlorids and sulphates in concentrations of 0.1, 1, and 10 per cent on Portland cement mixtures with sand, 1:3 and 1:6, when immersed in the solutions for periods as long as six months, showed that none of the solutions except that of calcium sulphate had an injurious effect on the 1:3 mixture. Calcium sulphate, on the other hand, showed evidences of a destructive influence. With the 1:6 mixture only the sulphate solutions had a destructive effect, but this was, however, very marked. The action was very arbitrary and irregular. The chlorids of calcium and magnesium produced an increase in the leaching out of lime from the cement, especially when the salt solutions were concentrated and the cement mixture lean.

Further studies are in progress on the effect of leaching solutions.

Some tests on hydrated lime addition to concrete for road work, E. Ashton (*Engin. and Contract., 45 (1916), No. 9, pp. 206, 207*).—Tests are briefly reported in which 5, 10, and 15 per cent by weight of hydrated lime was added to concrete.

The results showed that "no greater freedom of movement of the mass was noticed. As the lime was increased more difficulty was experienced in getting the material into the test forms. . . . With same angle and same percentage of water concrete did not flow more readily by the addition of hydrate of lime,

and as the percentage of hydrate of lime was increased the mass became more sticky and did not flow so readily. By far the most important observation made was that the addition of hydrate of lime did prevent segregation, and so much so as to make this the biggest gain that can be gotten from the use of hydrate of lime."

Experiments on wire rope, M. RUDELOFF (*Mitt. K. Materialprüfungsamt Berlin-Lichterfelde West, 33 (1915), No. 3–4, pp. 198–209, figs. 10*).—Experiments on the strength of four wire ropes gave inconclusive results. Experiments on the durability of three wire ropes containing, respectively, 294, 210, and 294 wires of 0.7, 0.68, and 0.59 sq. mm. cross section and having respective total wire cross sections of 113.1, 76.3, and 80.4 sq. mm. and total diameters of 20, 17, and 17 mm., are also reported. The second rope was found to be the most resistant and the third the least resistant.

Consideration on hauling by animal and mechanical power, F. ACHILLES (*Wchnschr. Brau., 32 (1915), Nos. 7, pp. 49–53, figs. 6; 8, pp. 62–64, figs. 2; 9, pp. 88–90, figs. 2*).—The results of an investigation into the factors affecting the efficiency and economy of hauling loads by animal power and by motor truck are reported in both tabular and graphic form and analyzed to determine the limits of the efficiency and economy of the two types of power under different conditions.

A final graphic comparison of the cost of hauling by the two kinds of power is made which is based on the cost per ton kilometer and the daily accomplishment in ton kilometers. This comparison shows that up to a daily accomplishment of about 200-ton kilometers animal power hauling one wagon for 100-ton kilometers per day and two wagons for from 100 to about 200 ton kilometers per day is more economical than one motor truck of 2 tons capacity. With a daily accomplishment of from 200 to 700 ton kilometers it is shown that the motor trtuck alone in varying capacities or a train of motor trucks is more economical than a train of from three to eight wagons drawn by animal power.

An economic study of the farm tractor in the corn belt, A. P. YERKES and L. M. CHURCH (*U. S. Dept. Agr., Farmers' Bul. 719 (1916), pp. 24, fig. 1*).—This bulletin reports and discusses data from selected reports from over 200 tractor owners in Illinois whose farms are typical of corn-belt conditions, the data being considered correct for conditions existing in the corn belt in the spring of 1916.

The principal points brought out by the experience of these owners are summarized as follows:

"The chief advantages of the tractor for farm work, in the opinion of the operators, are (1) its ability to do the heavy work and do it rapidly, thus covering the desired acreage within the proper season; (2) the saving of man labor, and the consequent doing away with some hired help; and (3) the ability to plow to a good depth, especially in hot weather. The chief disadvantages are difficulties of efficient operation and the packing of the soil when damp.

"The purchase of a tractor seldom lowers the actual cost of operating a farm, and its purchase must usually be justified by increased returns.

"One of the most important points in connection with the purchase of a tractor is to obtain one of suitable size for the farm on which it is to be used. In this connection experienced tractor owners in Illinois make the following recommendations:

"For farms of 200 crop acres or less, the 3-plow tractor; for farms of from 201 to 450 crop acres, the 4-plow tractor, with the 3-plow outfit second choice; for farms of from 451 to 750 crop acres, the 4-plow tractor, with the 5- and 8-plow outfits tied for second choice; a farm of 140 acres is the smallest upon which the

smallest tractor in common use, the 2-plow outfit, may be expected to prove profitable.

"Medium-priced tractors appear to have proved a profitable investment in a higher percentage of cases than any others.

"The life of tractors, as estimated by their owners, varies from 6 seasons for the two-plow to 10½ seasons for the 6-plow outfits. The number of days a tractor is used each season varies from 49 for the 2-plow to 70 for the 6-plow machines. No definite figures on the repair charges for late model tractors can be given; it would not seem safe, however, to count upon less than 4 per cent of the first cost annually (this representing the average for farm machinery in general).

"Under favorable conditions a 14-inch plow drawn by a tractor covers about 3 acres in an ordinary working day. Under unfavorable conditions large gang plows will cover less ground per day per plow pulled than will the small ones. Two and one-half gal. of gasoline and 0.2 gal. of lubricating oil are ordinarily required in actual practice to plow 1 acre of ground 7 in. deep. The size of the tractor has little influence on these quantities.

"Plows drawn by tractors do somewhat better work, on the whole, than horse-drawn plows. In Illinois the depth plowed by tractors averages about 1.5 in. greater than where horses are used. Efficient operation is essential to success with a tractor, and proficiency usually can be obtained more cheaply and easily by previous study and training than by experimenting with one's own tractor. With a proficient operator the tractor is a very reliable source of power.

"The use of the tractor for custom work is usually an indication that the home farm is not large enough to utilize it economically. The doing of custom work with the tractor, on the whole, appears to be a questionable practice, although nearly 45 per cent of machines are used for such work to some extent.

"A tractor displaces on an average about one-fourth of the horses on the farm where it is used. On a large number of Illinois farms brood mares constituted 33 per cent of the work stock before the purchase of the tractor. The use of the tractor increased this proportion only 3 per cent. . . . Both increases and decreases in the crop yields are reported from the use of the tractor, although favorable effects are more common than unfavorable. However, increases are not sufficiently frequent to warrant a farmer placing much dependence on the tractor in this respect."

The economics of the farm tractor, E. R. WIGGINS (*Power Farming, 25 (1916), No. 2, pp. 16, 45, 48, fig. 1; Farm Implements, 30 (1916), No. 2, pp. 58, 60, 62, 62A*).—The results of an investigation conducted in Nebraska on tractor costs are reported in detail, three systems of tractor farm management being considered, namely, (1) private ownership, (2) cooperative management, and (3) custom operation.

It is concluded that a study of costs of tractor operation does not entirely indicate the advantages of tractor over horse farming since, while there is a saving in favor of the tractor, the added investment necessary must be considered. "The advantage, however, comes . . . in the added work that can be done wiht the tractor, at the same cost, and besides all this, the tractor does not use materials that man can use to reduce the cost of living."

The proper bearings for farm tractor uses, C. M. EASON (*Farm Machinery, No. 1271 (1916), pp. 26, 27, fig. 1*).—This article deals with different types of antifriction bearings, bearing loads, bearings for radial loads only, rollers *v.* balls, and size and capacity of bearing. Roller bearings are favored for tractors.

Indigenous implements of the Bombay Presidency, G. K. KELKAR (*Dept. Agr. Bombay Bul. 66 (1914), pp. VI+100, pls. 26*).—This is a general survey of the indigenous implements of the Presidency proper which include plows, harrows, clod crushers, seed drills, interculturing and weeding implements, harvest-

ing implements, threshing appliances, winnowing and cleaning appliances, appliances in the preparation of crops for the market, appliances for transport of agricultural products, implements used in improvement of land, Konkan implements, mallad (a heavy rainfall tract of Karnátak) implements, hand tools, water lifts, and yokes and hitching. Appendixes are included giving a glossary of vernacular words of crops, the kinds of wood used in the manufacture of implements with their scientific names, and vernacular names of different parts of implements with their English equivalents.

Directory and specifications of plows for tractor use (*Farm Machinery, No. 1271 (1916), pp. 22, 23*).—This list includes 91 of the types manufactured in the United States.

Proper use of rams for farm water supplies, W. G. KIRCHOFFER (*Engin. News, 75 (1916), No. 10, pp. 457, 458, figs. 2*).—The hydraulics involved in the design of a hydraulic ram system of water supply are briefly presented, together with a specific example.

Concrete silos, E. S. HANSON (*Chicago: The Cement Era Publishing Co., 1916, pp. 174, figs. 78; rev. in West. Engin., 7 (1916), No. 2, pp. 78, 79; Engin. News, 75 (1916), No. 7, p. 319*).—This book represents an attempt to compile and summarize the present available knowledge of concrete silo construction. It contains the following chapters: Why build a silo? what a good silo should be; how concrete meets the requirements; advantage over other kinds of silos; size and shape of a silo; the different types of concrete silos; the foundation of the silo; the monolithic silo; the Polk system; the Monsco system; the Reichert system; other monolithic systems; the pit silo; the metal lath silo; the concrete stave silo; the concrete block silo; doorways, doors, roofs, etc.; and how to increase the silo business. It is stated that part of the material was drawn from bulletins of the state agricultural experiment stations.

RURAL ECONOMICS.

The agricultural element in the population, E. MERRITT (*Quart. Pubs. Amer. Statis. Assoc., n. ser., 15 (1916), No. 113, pp. 50–65*).—Among the conclusions brought out in this paper, presented at the annual meeting of the American Statistical Association, Washington, D. C., December 29, 1915, are that the principal reasons for the decreasing percentage of the total workers employed in agriculture are that the agricultural element in the population is becoming more efficient, and that in the readjustment or changes in the methods of producing and distributing agricultural products agricultural people now perform a smaller part of the complete operations than was the case formerly. As evidence of the increased efficiency are the facts that the agricultural workers are producing more crops per capita and use a smaller percentage of the total population for the purpose than formerly.

Another indication of the increased efficiency is the fact that the average number of acres of crops cultivated per agricultural worker is increasing and is accompanied by an increased number of horses on farms per agricultural worker and by an increase in the average yields per acre.

The decrease in the agricultural and rural population in the north Central States is due to a decreased number of farms and to smaller farm families.

The author states that anything that tends to upset the relationship between the supply and demand of labor in one field of endeavor sets in motion a migration from one part of the country to another or from one country to another, and that the relationships between the rural and urban population are rendered unstable owing to differences in death rate, birth rate, and migration.

Although the fecundity of married women in rural districts is greater than those of the same nativity in urban districts, the presence of a larger number of foreign born in cities causes the relative birth rates to appear about equal. When the death rate is compared, age for age, it is found to be higher in the urban than in the rural districts, the difference being greatest at those ages at which the largest number of deaths occur. Even if the birth rate for rural and urban districts were the same, the greater death rate in cities results in a smaller percentage of those born in cities reaching the productive age periods. Migration from rural districts apparently begins with those 10 to 15 years of age, and practically ceases at 35 years of age. The higher death rate in cities accounts for the fact that a large percentage of those in rural districts survive.

He also points out that the white females are migrating from rural districts in greater numbers than males, and that their migration begins at an earlier age. The extensive use of agricultural machinery in the United States is probably the cause of this migration from rural districts. As long as the women are employed in the fields they contribute to the farm income. When an agricultural machine is introduced it not only takes away the field work of the farm women so that they become of less economic value on the farm, but it also makes them seek remunerative employment elsewhere.

Information for prospective settlers in Alaska, C. C. Georgeson (*Alaska Stas. Circ. 1 (1916), pp. 30, pls. 5*).—This circular is based largely on the results of the station's work. It is estimated that in the whole Territory there are about 100,000 square miles which can be made available for tilling and for grazing purposes, but about one-half of this area has little value except for the latter purpose. General information is given concerning the climate, agricultural conditions, how to obtain a farm, chances for work and wages paid, transportation facilities, cost of living, crops and live stock, population, means of communication, etc.

An article by M. D. Snodgrass is included pointing out some of the problems confronting early settlers in the Matanuska Valley. Methods of clearing the land at present are various and crude, including grubbing with mattock and shovel, cutting some of the roots and lining with rope through a lead block, pulling stumps with homemade stump pullers, and burning during the dry seasons. The principal crops in this area are barley, oats, rye, potatoes, cabbage, turnips, rutabagas, carrots, tomatoes, cauliflower, beets, and most of the common garden vegetables. Wild fruits are abundant in this region, consisting of currants, blueberries, salmonberries, raspberries, gooseberries, cranberries, and a number of other edible sorts. The strawberries so common on the coast of southeastern Alaska are not found in the Matanuska country, but wherever planted they grow well.

Under the present homestead laws any person who has not used his homestead rights may take up 320 acres of land (160 acres in the National Forests) and acquire patent thereto by establishing his residence on the land and putting one-eighth of it under cultivation within three years after taking up the land. On the whole, the amount of land allowed is deemed more than the ordinary man can handle and comply with the laws; 160 acres being regarded as sufficient for the average person.

Statistics of the food supply in Germany, R. M. Woodbury (*Quart. Pubs. Amer. Statis. Assoc., n. ser., 15 (1916), No. 113, pp. 93–109*).—This paper, read at the annual meeting of the American Statistical Association, Washington, D. C., December 29, 1915, is a review of discussions by various authors as to the possibilities of a decision of the European War being brought about by the starvation of Germany. After reviewing the literature the author concludes:

"There is little possibility that Germany can be starved. Her supplies are probably sufficient to cover the minimum practical requirement. Her food supply falls considerably short of the actual rate of consumption in 1912–13, and it must be conserved and carefully distributed to insure a sufficiency in the last months before the new harvests are available. There are distinctly less meat and animal products available than in normal times. The serious danger, it seems to me, is that disaffection may be spread among the working classes by restrictions on the consumption of foodstuffs, and above all by the increase in prices, which may seem to them entirely unnecessary if, as the government has announced, there is really enough food for all."

Settlement or employment on the land in England and Wales of discharged sailors and soldiers (*Final Rpt. Dept. Com. Land Settlement Sailors and Soldiers, 1915, pt. 1, pp. 30, pl. 1*).—In this report are considered methods of settlement, advisability of ownership and tenancy, selection and training of settlers, and provision for expert guidance and working capital.

The use of agricultural motors and machinery, D. H. Gorría (*Mem. R. Acad. Cien y Artes Barcelona, 3. ser., 12 (1915), No. 4, pp. 27*).—The author discusses the importance of machinery in the agricultural systems of various countries, its influence upon the relation of food supply to the population, and the relation of the use of machinery to the development of Spanish agriculture.

A farm management demonstration on 161 Chautauqua County farms for the year 1914, H. B. Rogers (*Chautauqua Co. [N. Y.] Farm Imp. and Inform. Bur. Bul. 1 (1916), pp. 14, fig. 1*).—This bulletin gives a brief summary of the results obtained in a farm management survey of 161 Chautauqua County farms made in connection with the extension work of the county agricultural agent in 1914.

Marketing and farm credits (*Madison, Wis.: Nat. Conf. Marketing and Farm Credits, 1916, pp. IX+531*).—This report consists of papers read at the third annual session of The National Conference on Marketing and Farm Credits in joint program with The National Council of Farmers' Cooperative Associations, in Chicago, November 29 to December 2, 1915. It deals with the following subjects: Organizing agricultural cooperation, marketing farm products, standardization of farm products, warehousing and standardization of farm products, local and terminal elevators, rural credit aids to land purchase, present facilities for land purchase and need of legislation, and financing the farm business.

Farmers' market bulletin (*North Carolina Sta., Farmers' Market Bul., 3 (1916), No. 16, pp. 32, fig. 1*).—This includes the usual list of farm products for sale, and brief discussions of the benefits that may accrue to the cotton farmers through organization in improving their products, establishing uniform grades of cotton, warehousing, and securing credit and better prices for their products. The text of an act passed in 1915 relating to the incorporation, maintenance, and supervision of credit unions and cooperative associations in North Carolina is also given.

Live stock shipping associations (*Wallaces' Farmer, 41 (1916), No. 10, p. 425*).—This article gives a brief description of a live stock shipping association formed at Farmington, Minn., together with the constitution and by-laws.

A system of accounts for primary grain elevators, J. R. Humphrey and W. H. Kerr (*U. S. Dept. Agr. Bul. 362 (1916), pp. 30, pls. 3*).—Fifteen forms are given, with a description of their use for a system of accounts with an idea of establishing a uniform system for primary grain elevators. These forms are as follows: (1) Cash, journal, purchase, and sales record; (2) record of grain receipts; (3) record of grain purchases; (4) record of grain shipments and sales; (5) record of hedges; (6) record of sales to arrive; (7) patronage ledger

(for cooperative elevators); (8) grain and merchandise report; (9) manager's report; (10) grain check; (11) scale ticket; (12) storage ticket; (13) sales ticket; (14) cash receipt; and (15) cost analysis.

Agricultural statistics of Saxony, WÜRZBURGER (*Statis. Jahrb. Königr. Sachsen, 42 (1914–15), pp. 104–129*).—This continues information previously noted (E. S. R., 31, p. 96) adding data for 1913–14.

AGRICULTURAL EDUCATION.

Proceedings of the twenty-ninth annual convention of the Association of American Agricultural Colleges and Experiment Stations and of the fourth annual convention of the Land-Grant College Engineering Association, edited by J. L. HILLS (*Proc. Assoc. Amer. Agr. Cols and Expt. Stas. and Land-Grant Col. Engin. Assoc., 1915, pp. 304*).—This is a detailed account of the proceedings, including the papers submitted, of these two conventions held at Berkeley, Cal., August 11–13, 1915 (E. S. R., 33, p. 301).

The proceedings of the convention of the Association of American Agricultural Colleges and Experiment Stations include the Report of the Bibliographer, A. C. True, submitting a list of documents that record the history of agricultural extension legislation, together with a brief summary of the chief factors in bringing it about (pp. 32–44); report of the committee on instruction in agriculture on College Courses for the Preparation of Extension Workers (pp. 45–70); report of the committee on college organization and policy including a discussion of the forms of organization in various land-grant agricultural institutions, tentative outlines of a plan for study of college organization and policy, and a bibliography of college organization and administration (pp. 104–123); report of the committee on experiment station organization and policy dealing with the functions of the stations in relation to various forms of regulatory activity (pp. 123–125); report of the committee on extension organization and policy offering suggestions toward standardization of methods of administration (pp. 125–129); and the following addresses:

Address of Welcome, B. I. Wheeler (pp. 19, 20); The Presidential Address, on A National System of Education, E. A. Bryan (pp. 72–82); An Account of the Methods of Work of the Agricultural Institutions in California, T. F. Hunt (pp. 83–90); The Exhibit in Agricultural Education at the Panama-Pacific International Exposition, A. C. True (pp. 91–94); Economic Science in Agricultural and Mechanical Colleges, C. A. Duniway (pp. 94–96); The Preparation of Teachers as Contemplated in the Nelson Amendment, A. R. Hill (pp. 96–100); Exchange of Instructors in Agricultural College Work, H. L. Russell (pp. 102–104); The Correlation of the College of Agriculture with the Other Colleges of the State, A. Vivian (pp. 130–134); The Place of Mechanic Arts in Land-grant Institutions, R. A. Pearson (pp. 135–140); The Relation of the Bureau of Education to the Agricultural Colleges, S. P. Capen (pp. 140–146); Federal Aid to Engineering Experiment Stations, F. G. Newlands (pp. 146–150); The Preparation Required for the College Teacher in Agriculture, R. A. Pearson (pp. 156–159); The Preparation Required for Research Work in Agriculture, T. F. Hunt (pp. 159–161); The Preparation Required for Extension Work in Agriculture, A. C. True (pp. 161–165); The Administration of Engineering Divisions of Land-grant Colleges, H. J. Waters (pp. 168–171); Duplication in Engineering Between Land-grant Institutions and State Universities, A. Marston (pp. 171–177); The Annual Report, R. H. Forbes (pp. 179–182); Bulletins, H. G. Knight (pp. 182–185); The Publication of the Results of Investigations Made in Experiment Stations in Technical Scientific Journals, Including the Journal of Agricultural Research, R. Pearl (pp. 186–191) previously noted (E. S. R., 33, p. 401); Effective Correlation of Station and Extension Workers,

viewed from the standpoint of the extension director, Bradford Knapp (pp. 199, 200); The Effective Correlation of Station and Extension Workers from the Standpoint of Station Work, C. E. Thorne (pp. 200–202); The Best Means of Securing Proper Recognition and Credit for Station Work in Extension Work, H. L. Russell (pp. 202, 203); What Can the Stations do to Encourage More Men to Fit Themselves for Advanced Research? C. D. Woods (p. 206); The Place Which Demonstration Should Have in Extension Work, Bradford Knapp (pp. 209–213); County Organization of Extension Work in Agriculture and Home Economics, C. A. Keffer (pp. 214–219); The Organization of Cooperative Extension Work, Machinery and Method (in the State), B. T. Galloway (pp. 220–224); The Organization of Cooperative Extension Work, Machinery and Method (in the Federal Department of Agriculture), A. C. True (pp. 228–231); Shall Extension Service Include the Social, Recreational and Educational Improvement of Rural and Urban Districts? W. D. Hurd (pp. 232–241); Organization and Methods of Home Economics Extension, Mrs. H. W. Calvin (pp. 241–246); and Home Demonstrations, Miss Mary E. Creswell (pp. 247–252).

The proceedings of the convention of the Land-Grant College Engineering Association include the report of a special committee on fees for professional (engineering) services in land-grant colleges (pp. 259–265); report of the committee on extension texts (pp. 271–274); and the following addresses: Presidential Address, H. W. Tyler (pp. 257, 258); Adaptation of Engineering Education to Local Needs, A. W. Richter (pp. 274–277); Correlation of Courses of Study in Engineering, G. A. Covell (pp. 277–281); Bill for the Establishment of Mechanic Arts Experiment Stations, O. L. Waller (p. 281); The Adaptation of Engineering Experiment Stations to Local Needs, F. E. Turneaure (pp. 281–283); The Relation of the Engineering Experiment Station to the College of Engineering, C. S. Nichols (pp. 284, 285); and Lessons to be Drawn from the Experience of the Agricultural Experiment Stations, O. V. P. Stout (pp. 286–294).

The progress of productive pedagogy, S. G. Rubinow (*School and Society, 2 (1915), No. 51, pp. 879–884*).—The author gives an account of the progress of agricultural instruction, beginning with the organization of agricultural societies in 1785.

The home project as the center v. the home project as the outgrowth of agricultural instruction, C. G. Selvig (*School Ed., 35 (1916), No. 6, pp. 4, 5*).—The author holds that home project work may more profitibly be organized as an outgrowth than as the center of agricultural instruction. Students electing agriculture should have a complete course as organized for their community, embracing definite class, laboratory, and home work. It is a waste of time and effort to treat each individual separately through his separate and distinct project in home work, as the most important general principles, which are of importance to all, can better be taught in the regular classes. Further, while the requirement of some home project will increase the student's grasp of all phases of instruction involved in it, it is impossible to embody all principles in any such project, and it must necessarily be considered somewhat incidental in the course. Hence home project work should not be substituted for class work, but should be organized into a closer relationship with theory and practice. The author considers the productive home project, excepting perhaps a garden or poultry project, of no interest to 80 per cent of the boys in Minnesota high-school classes in agriculture. Out of 104 of these schools reporting, 66 report some form of home project work, and 15 will require such work this year.

Problems in farm woodwork, S. A. Blackburn (*Peoria, Ill.: The Manual Arts Press, 1915, pp. 129, fig. 60*).—This book aims to present the forms, dimen-

sions, and other construction data for objects that can be correlated with work in agriculture in agricultural, high, industrial, and country schools. It includes problems dealing with the shop, poultry raising, seed-corn storage, the yard, house, and garden, stock raising, the barnyard, beekeeping, concrete forms, etc.

Ohio Agricultural Day (*Columbus, Ohio: Bd. Agr., 1915, pp. 31, figs. 5*).—This manual contains program material and suggestions for the observation of Agricultural Day in Ohio, on November 12, 1915, by the schools, churches, granges, chambers of commerce, and other organizations.

MISCELLANEOUS.

Annual report of the director of the experiment station on work done under the local experiment law in 1915, J. F. Duggar (*Alabama Col. Sta. Circ. 34 (1916), pp. 31*).—This includes a report by the director on the progress of the work under this law (E. S. R., 24, p. 400), a financial statement for the year, and reports from heads of departments, including detailed reports of boys' and girls' club work.

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul. 245 (1915), pp. 289–334+XVI, fig. 1*).—This contains the organization list of the station; abstracts of 14 papers published elsewhere and previously noted, and an abstract of the paper noted on page 279 of this issue; meteorological observations noted on page 209; a financial statement for the fiscal year ended June 30, 1915; an index to Bulletins 235 to 245, inclusive, which collectively constitute the thirty-first annual report of the station; an index to the reports from 1911 to 1915; and announcements as to the work, personnel, publications, and equipment of the station.

Fourth and Fifth Annual Reports of the Dickinson, North Dakota, Substation, 1911 and 1912 (*North Dakota Sta. Rpts. Dickinson Substa., 1911, pp. 14; 1912, pp. 17*).—These reports contain the organization list and an administrative report on the work of the substation during the years 1911 and 1912, respectively, including meteorological data noted on page 209 of this issue.

Sixth Annual Report of the Dickinson, North Dakota, Substation, 1913 (*North Dakota Sta., Rpt. Dickinson Substa., 1913, pp. 40, figs. 11*).—This contains the organization list and a report on the work of the substation during 1913. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of the Hood River, Oregon, Branch Experiment Station, 1913–14 (*Oregon Sta., Bien. Rpt. Hood River Sta., 1913–14, pp. 50, fig. 1*).—This contains reports of the director of the Oregon Station and heads of departments on the work of this substation, the experimental features of which are for the most part abstracted elsewhere in this issue, and an article on The Farm Vegetable Garden noted on page 234.

Report of the Umatilla, Oregon, Branch Experiment Station, 1914, R. W. Allen (*Oregon Sta., Rpt. Umatilla Sta., 1914, pp. 11, figs. 2*).—This contains a description of the substation, its resources and purposes, soil, climatic, and other conditions, and types of experimental work, and discusses the value of the substation. See also a previous note (E. S. R., 30, p. 441).

Twenty-eighth Annual Report of Rhode Island Station, 1915 (*Bul. R. I. State Col., 11 (1916), No. 4, pp. 23–29, 37–39*).—These pages include a report of the director and a financial statement for the fiscal year ended December 31, 1915. The experimental work reported with field crops is abstracted on page 229 of this issue.

Index to Farmers' Bulletins Nos. 1–500, prepared by C. H. Greathouse (*U. S. Dept. Agr., Index Farmers' Buls. 1–500, pp. 432*).

NOTES.

Connecticut State Station.—G. L. Davis, assistant chemist since 1913, terminated his work at this station in June.

Iowa College.—George W. Iverson, instructor in agricultural engineering, has resigned to become farm-engineering editor of a chain of agricultural publications.

Kansas College and Station.—The honorary degree of LL. D. was bestowed upon President H. J. Waters by the University of Missouri at its recent commencement.

Dr. C. M. Brink, professor of English literature and dean emeritus of the college, died June 29. He had been with the institution since 1902 and served as dean of the college from 1909 until his recent retirement.

W. A. Lippincott, poultry husbandman, has been given a year's leave of absence for graduate work in genetics at the University of Wisconsin.

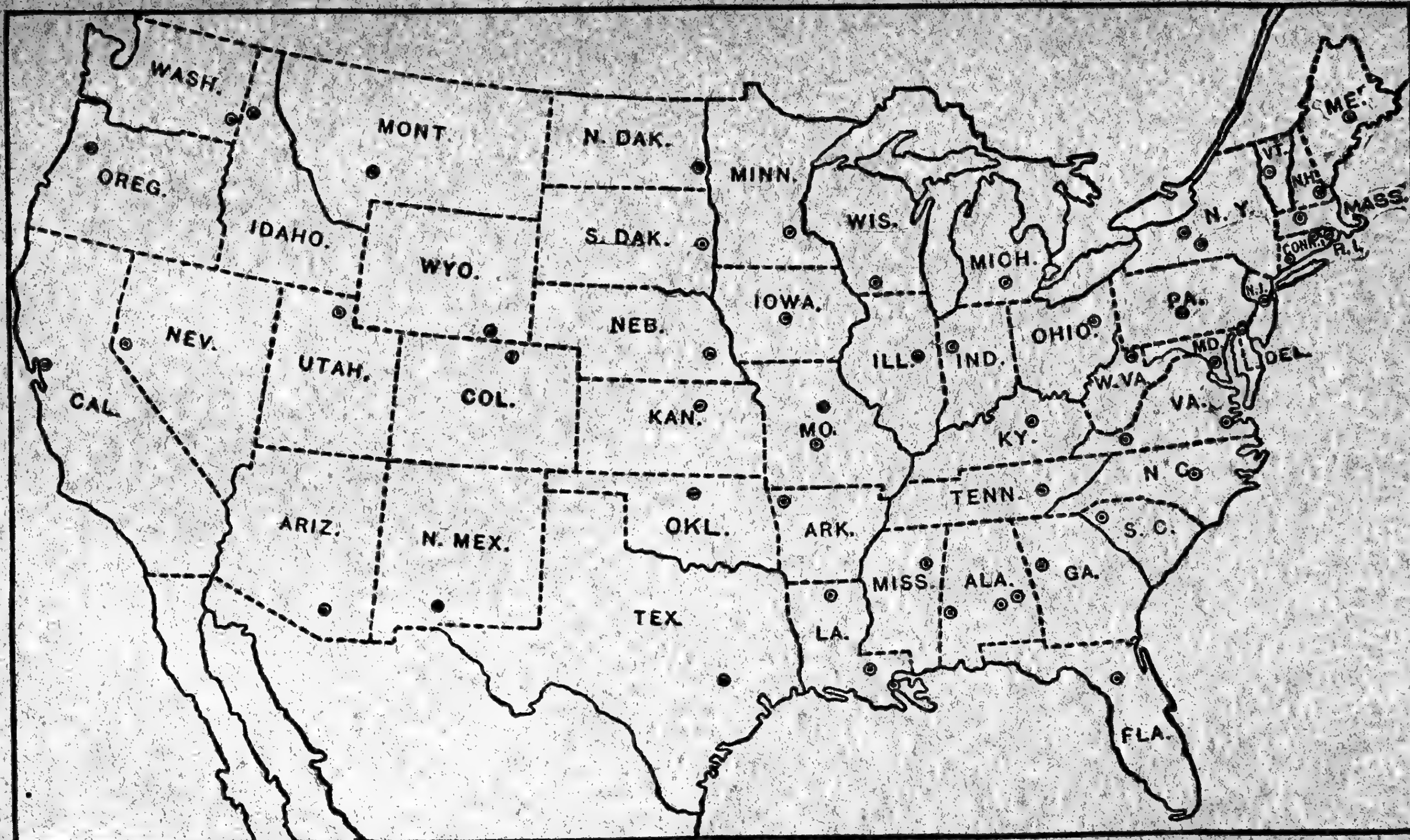
In the extension division, Miss Minnie Sequist has been appointed specialist in home economics and Miss Mary Wright specialist in domestic arts, both appointments beginning September 1. R. P. Schnacke and F. B. Williams have been appointed county agents for Pawnee and Marshall counties, respectively, and have entered upon their duties. Including the 16 county agents and 5 district agents at work in the State, there are now 42 men and 6 women devoting full time to the extension work of the college. A conference of the members of the division of extension was held at the college June 12–17 for the discussion of organization, policies, and relationship between county and district agents, extension specialists, and specialists of the division of agriculture.

Minnesota University and Station.—Dr. R. A. Gortner, associate professor of soil chemistry, has been transferred to the division of agricultural biochemistry with the title of associate professor of agricultural biochemistry and in charge of the section of biochemical research.

Missouri Station.—Henry Cohn has succeeded C. E. Deardorff, resigned, as assistant in the soil survey. A. F. Ridgway has been appointed assistant in veterinary science.

Nebraska University and Station.—Dr. Raymond J. Pool has been appointed permanent head of the department of botany. C. A. Helm, instructor and assistant in experimental agronomy, has resigned to become assistant professor of agronomy in the University of Missouri. William Rabak has been appointed instructor in agricultural chemistry and assistant in agricultural chemistry in the station.

New Jersey Stations.—Samuel U. Hoddeson and Joseph J. Williams have resigned as assistant chemists. Louis J. Kleinfeld and D. James Kay have been appointed assistant chemists; H. C. Haines, assistant extension specialist in fruit growing; Miss E. P. Leeds, assistant State leader of girl's club work; and David Schmidt, field assistant in horticulture.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U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
A. C. TRUE, DIRECTOR

Vol. 35 SEPTEMBER, 1916 No. 4

EXPERIMENT STATION RECORD

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

U. S. DEPARTMENT OF AGRICULTURE.

Scientific Bureaus.

WEATHER BUREAU—C. F. Marvin, *Chief.*
BUREAU OF ANIMAL INDUSTRY—A. D. Melvin, *Chief.*
BUREAU OF PLANT INDUSTRY—W. A. Taylor, *Chief.*
FOREST SERVICE—H. S. Graves, *Forester.*
BUREAU OF SOILS—Milton Whitney, *Chief.*
BUREAU OF CHEMISTRY—C. L. Alsberg, *Chief.*
BUREAU OF CROP ESTIMATES—L. M. Estabrook, *Statistician.*
BUREAU OF ENTOMOLOGY—L. O. Howard, *Entomologist.*
BUREAU OF BIOLOGICAL SURVEY—H. W. Henshaw, *Chief.*
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OFFICE OF MARKETS AND RURAL ORGANIZATION—C. J. Brand, *Chief.*

STATES RELATIONS SERVICE—A. C. True, *Director.*
OFFICE OF EXPERIMENT STATIONS—E. W. Allen, *Chief.*

THE AGRICULTURAL EXPERIMENT STATIONS.

ALABAMA—
College Station: *Auburn;* J. F. Duggar.[a]
Canebrake Station: *Uniontown;* L. H. Moore.[a]
Tuskegee Station: *Tuskegee Institute;* G. W. Carver.[a]
ALASKA—*Sitka:* C. C. Georgeson.[b]
ARIZONA—*Tucson:* G. F. Freeman.[c]
ARKANSAS—*Fayetteville:* M. Nelson.[a]
CALIFORNIA—*Berkeley:* T. F. Hunt.[a]
COLORADO—*Fort Collins:* C. P. Gillette.[a]
CONNECTICUT—
State Station: *New Haven;* } E. H. Jenkins.[a]
Storrs Station: *Storrs;* }
DELAWARE—*Newark:* H. Hayward.[a]
FLORIDA—*Gainesville:* P. H. Rolfs.[a]
GEORGIA—*Experiment:* R. J. H. De Loach.[a]
GUAM—*Island of Guam:* A. C. Hartenbower.[b]
HAWAII—
Federal Station: *Honolulu;* J. M. Westgate.[b]
Sugar Planters' Station: *Honolulu;* H. P. Agee.[a]
IDAHO—*Moscow:* J. S. Jones.[a]
ILLINOIS—*Urbana:* E. Davenport.[a]
INDIANA—*La Fayette:* A. Goss.[a]
IOWA—*Ames:* C. F. Curtiss.[a]
KANSAS—*Manhattan:* W. M. Jardine.[a]
KENTUCKY—*Lexington:* J. H. Kastle.[a]
LOUISIANA—
State Station: *Baton Rouge;* }
Sugar Station: *Audubon Park, New Orleans;* } W. R. Dodson.[a]
North La. Station: *Calhoun;* }
MAINE—*Orono:* C. D. Woods.[a]
MARYLAND—*College Park:* H. J. Patterson.[a]
MASSACHUSETTS—*Amherst:* W. P. Brooks.[a]
MICHIGAN—*East Lansing:* R. S. Shaw.[a]
MINNESOTA—*University Farm, St. Paul:* A. F. Woods.[a]
MISSISSIPPI—*Agricultural College:* E. R. Lloyd.[a]
MISSOURI—
College Station: *Columbia;* F. B. Mumford.[a]
Fruit Station: *Mountain Grove;* Paul Evans.[a]
MONTANA—*Bozeman:* F. B. Linfield.[a]
NEBRASKA—*Lincoln:* E. A. Burnett.[a]
NEVADA—*Reno:* S. B. Doten.[a]
NEW HAMPSHIRE—*Durham:* J. C. Kendall.[a]
NEW JERSEY—*New Brunswick:* J. G. Lipman.[a]
NEW MEXICO—*State College:* Fabian Garcia.[a]
NEW YORK—
State Station: *Geneva;* W. H. Jordan.[a]
Cornell Station: *Ithaca;* A. R. Mann.[c]
NORTH CAROLINA—
College Station: *West Raleigh;* } B. W. Kilgore.[a]
State Station: *Raleigh;* }
NORTH DAKOTA—*Agricultural College:* T. P. Cooper.[a]
OHIO—*Wooster:* C. E. Thorne.[a]
OKLAHOMA—*Stillwater:* W. L. Carlyle.[a]
OREGON—*Corvallis:* A. B. Cordley.[a]
PENNSYLVANIA—
State College: R. L. Watts.[a]
State College: Institute of Animal Nutrition; H. P. Armsby.[a]
PORTO RICO—
Federal Station: *Mayaguez:* D. W. May.[b]
Insular Station: *Rio Piedras:* W. V. Tower.[a]
RHODE ISLAND—*Kingston:* B. L. Hartwell.[a]
SOUTH CAROLINA—*Clemson College:* J. N. Harper.[a]
SOUTH DAKOTA—*Brookings:* J. W. Wilson.[a]
TENNESSEE—*Knoxville:* H. A. Morgan.[a]
TEXAS—*College Station:* B. Youngblood.[a]
UTAH—*Logan:* F. S. Harris.[a]
VERMONT—*Burlington:* J. L. Hills.[a]
VIRGINIA—
Blacksburg: A. W. Drinkard, jr.[a]
Norfolk: Truck Station; T. C. Johnson.[a]
WASHINGTON—*Pullman:* I. D. Cardiff.[a]
WEST VIRGINIA—*Morgantown:* J. L. Coulter.[a]
WISCONSIN—*Madison:* H. L. Russell.[a]
WYOMING—*Laramie:* H. G. Knight.[a]

[a] Director. [b] Agronomist in charge. [c] Acting director.

EXPERIMENT STATION RECORD.

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SUBJECT LIST OF ABSTRACTS.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

METEOROLOGY.

SOILS—FERTILIZERS.

AGRICULTURAL BOTANY.

FIELD CROPS.

HORTICULTURE.

FORESTRY.

DISEASES OF PLANTS.

RURAL ECONOMICS.

AGRICULTURAL EDUCATION.

MISCELLANEOUS.

LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

U. S. Department of Agriculture—Contd.

U. S. Department of Agriculture—Contd.

[a] Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

Vol. 35. September, 1916. No. 4.

As the years go by, the annual acts making appropriations for the support of the Federal Department of Agriculture are coming to be recognized more and more as of wide public interest. They serve to epitomize the development and progress of the Department and to emphasize its intimate relations with the daily life of the whole American people. They constitute the medium in which provision is made from time to time for new and enlarged activities, as in the development of demonstration work and the prosecution of marketing studies. Quite frequently they embody important pieces of legislation, as in the meat-inspection amendment of 1906, the Nelson amendment of 1907 increasing the appropriations to the agricultural colleges, and the virus-serum-toxin and the migratory-bird provisions of the act of 1913.

The latest of these acts, covering the fiscal year ending June 30, 1917, is fully as important and interesting in these respects as any of its predecessors. It considerably extends and enlarges the functions and activities of the Department and establishes a new high-water mark in the appropriations for its maintenance. Among other provisions it materially increases the funds available for marketing studies, the eradication of the cattle tick in the South, the combating of rabies in the Rocky Mountain States, and the farmers' cooperative demonstration work outside the cotton belt, as well as for most of the regulatory services of the Department. It inaugurates a market news service and includes, as a new item, studies and demonstrations of methods for obtaining potash on a commercial scale. It provides for the expenditure of $3,000,000 for additional purchases of lands in the White Mountains and the southern Appalachian system for development as National Forests. It repeals the United States Cotton-Futures Act of 1914 and substitutes a modification of that measure, and it embodies, among other new legislation, provisions to be known as the United States Grain-Standards Act and the United States Warehouse Act.

The new law was introduced into the House of Representatives March 4, following hearings extending over a period of nearly six weeks. As usual, many of its provisions received detailed considera-

tion from Congress, and it did not finally become law until August 11. During the interval which followed the termination of the preceding fiscal year on June 30 the maintenance of the Department was provided for by the passage of special acts extending the appropriations, under certain restrictions, on the basis of the act for the previous year.

The appropriations carried in the new act aggregate $26,948,852. This is an increase of $2,349,763 over the estimates submitted by the Department and an increase of $3,977,070 over the amount carried in the act for the previous year. If comparison between the two fiscal years 1916 and 1917 is attempted, however, an addition should be made to the appropriations for the former year of deficiency items aggregating $395,000, and a deduction of $2,000,000 made from those carried by the new act, since this sum, provided for forest reserve purchases, is not available until the following year. On this basis the increase becomes $1,582,070.

Considering the allotments to the various Bureaus, the Weather Bureau receives $1,747,260. This is an increase of $81,210, of which $40,000 is for the extension of the weather service to the Carribean Sea region, the Panama Canal Zone, and Alaska. It also includes $10,000 for an extension of the frost-warning and river and flood control work and $22,500 for the erection of a building at Cape Henry, Virginia.

The appropriations directly allotted to the Bureau of Animal Industry aggregate $3,020,746, but this is supplemented by extensive funds provided elsewhere. The total corresponding allotments for the previous year were $2,585,336, so that the increase granted is considerable.

The inspection and quarantine work of the Bureau against animal diseases receives $532,780, a decrease of $75,000, due to the reduced area under quarantine for sheep and cattle scabies. For pathological studies of animal diseases $138,020 is granted, of which $50,000 is a new item authorizing work on contagious abortion.

For the tick-eradication campaign an appropriation of $632,400 is given, and it is expected that this will be supplemented by State and county funds sufficient to make a total of nearly $1,000,000. Of this amount $50,000 may again be used for live-stock and dairy demonstration work in cooperation with the States Relations Service in areas freed of ticks. During the past year 49,629 square miles of territory were freed from infestation, reducing the area under quarantine to 453,761 square miles. It is now believed that complete eradication is entirely feasible.

The act carries $360,000 to continue the hog-cholera work, of which $175,000 may be used for the enforcement of the virus-serum-toxin

act and $35,000 for research. An allotment of $75,000 is also made for the investigation, treatment, and eradication of dourine.

The eradication of foot-and-mouth disease is followed by a reduction in the emergency appropriation for this and similar diseases from $2,500,000 to $1,250,000, plus the unexpended balance of $655,-790.93 from the previous year. This amount is available not only for the actual combating of the diseases but for the payment of claims in connection with outbreaks. It is provided that payments may be made for animals hereafter purchased on an appraisement based on their meat, dairy, or breeding value, but in case of appraisement on the basis of breeding value it can not exceed three times the meat or dairy value of the animals, and except in extraordinary emergency Federal payments can not exceed one-half the appraisement.

The meat-inspection work is continued much as at present, a permanent appropriation of $3,000,000 per annum being augmented by a supplementary allotment of $344,500.

A net increase of $27,620 is provided for the encouragement of dairying and one of $19,260 for that of animal husbandry, making $277,470 and $208,320, respectively, available for these purposes. It is planned to extend especially the studies in dairy farming, dairy research, the milk and cheese investigations and demonstrations, and the studies of pork production, Shorthorn cattle breeding, poultry breeding, range sheep breeding and management, and the classification of wools.

A special appropriation of $60,000 is continued for the work in live-stock production in the cane-sugar and cotton districts, now being conducted in close cooperation with the State of Louisiana. This State has deeded to the Department a farm of about 500 acres at New Iberia, and this farm has been divided into four tracts for work with horses and mules, beef cattle, dairy cattle and hogs, and hogs alone. A large number of demonstrations and other extension work in animal production and dairying are also under way. Somewhat similar work is contemplated under a new appropriation of $40,000 for experiments in dairying and live-stock production in semiarid and irrigated districts of the Western States.

The Bureau of Plant Industry receives an increase from $2,139,150 to $2,537,120, its appropriations being divided as usual among a large number of projects. Among the most important new items is that allotting $250,000 and the unexpended balance of about $85,000 from a deficiency appropriation of $300,000 from the previous year for continuing the campaign against the highly infectious disease known as citrus canker. Another large increase is that of $30,000 for studies of white-pine blister rust and other epidemic tree diseases.

Other extensions of work provided for include $6,500 for studies of tobacco diseases, $5,000 for citrus and subtropical fruit diseases and a like amount for breeding disease-resistant citrus varieties, $2,500 for carrying on soil studies in connection with the powdery scab of potato, $5,000 for extension work in cotton growing and $3,000 for cotton diseases, $5,000 for the development of work on plant-infesting nematodes, $8,350 for establishing a new grain-standardization laboratory in Minnesota, $7,500 for studies on the handling, grading, and transportation of the grain sorghums, $7,500 for studies of the water requirements of crops in the irrigated regions, $22,500 for investigations of black rust and stripe rust of wheat, oats, and barley, and other cereal diseases, $10,000 for the development of an American sugar-beet seed industry, and $21,000 to extend and develop the forage-crop investigations and provide for the more effective distribution of new and rare varieties of seeds. The seed-importation act of 1912 is extended to include vetch and rye grass, and the importation of seed of Kentucky bluegrass and Canada bluegrass is prohibited unless containing at least 50 per cent of live pure seed, while the importation of all other seed subject to the act is prohibited unless it contains 65 per cent of live pure seed. The congressional seed distribution is continued on the usual basis with an allotment of $252,540.

The allotments for the Forest Service, as usual, far exceed those for any other bureau. The aggregate is $8,549,735, but, as previously explained, $3,000,000 of this sum is for additional purchases under the Appalachian Forest Reserve Act, $2,000,000 of which is not available until July 1, 1917. An appropriation of $100,000 is also continued for cooperation with the States in fire protection work under the same act. Authority is granted for the prospecting, development, and utilization of the mineral resources of these lands and for the President to set aside suitable areas thereon for the protection of game animals, birds, and fish. In each case regulations are to be prescribed by the Secretary of Agriculture. An arrangement is made whereby timber purchasers may henceforth advance the cost of brush disposal on their cuttings on National Forests, in which case the Department itself will carry on this work at safe and opportune times. The remaining work of the Service is provided for without substantial change, provision being made for the continued administration, protection, and development of the National Forests, and for the varied investigations relating to the practice of forestry and the utilization of forest products.

The appropriation for the Bureau of Chemistry aggregates $1,153,801, of which over half is for the enforcement of the Food and Drugs Act. The purchase and equipment of a traveling laboratory at a cost of $7,500 is authorized. The various lines of work

under way are continued without change, and $50,000 is added for studies of the utilization for coloring purposes of raw domestic materials. The Bureau has been studying dyestuffs, more particularly with reference to their use in food products, for over ten years, and it is planned to continue this work, extending it to methods of manufacture of dyes from domestic products. The studies of naval stores were also definitely assigned to the Bureau of Chemistry, and $5,000 additional was granted to carry on demonstrations of improved methods for preparing these commodities.

The Bureau of Soils is granted $175,000 for experiments and demonstrations to determine the best methods of obtaining potash on a commercial scale. The remaining lines of work of the Bureau are continued unchanged, the total appropriation being $503,735.

An increase of $38,980 is accorded the Bureau of Entomology. This is divided among a number of projects, including extension work in bee culture, and studies of the grape-berry moth, clover seed midge, clover root borer, tobacco hornworm, insects instrumental in the carriage of cucumber diseases, and biting flies and other insects affecting the health of domestic animals. The gipsy and brown-tail moth campaign is allotted $305,050 and the Bureau as a whole $868,880.

The Bureau of Biological Survey is granted $578,230. The principal change is an increase of $125,000 to be used on the public lands, National Forests, and elsewhere in the Western and Northwestern States to combat the spread of rabies by destroying wolves, coyotes, and other predatory wild animals. This appropriation followed a serious outbreak of the disease in these States, in which serious losses to live stock and even human cases of the disease resulted from an epidemic among coyotes, and continues work begun earlier in the year under a deficiency appropriation of $75,000.

The total appropriation for the States Relations Service is $2,969,680, as compared with $2,821,840 for the previous year. The main item of increase is one of $100,000 for the farmers' cooperative demonstration work outside the cotton belt. This will permit of considerable further extension of that work and of initiating in a small way extension work by women county agents. There is also an increase of $23,000 for the experiment stations in Alaska, Hawaii, and Porto Rico. Most of this increase is in lieu of the receipts from the sales of farm products which were formerly available to the insular stations for carrying on their work, but which, since June 30, 1915, have been required to be deposited in the United States Treasury to the credit of miscellaneous receipts and are not available for station use. Additional funds are likewise provided for the administrative and general expenses of the Service by reason of its

increased activities. The other lines of work, including the maintenance of the State experiment stations, the farmers' cooperative demonstration work in the cotton belt, the study of farmers' institutes and agricultural schools, and the investigations in home economics are continued on the existing basis.

The funds allotted to the Office of Markets and Rural Organization are nearly doubled, the total of $872,590 allowing for a considerable expansion in its work. During the crop season of 1915 an experimental news service was conducted, giving timely information on the movements and prices of the strawberry, tomato, cantaloup, and peach crops, with such successful results that $136,600 is now provided for systematic service in the collection and distribution of market news by telegraph for perishable fruits and vegetables and by mail for other farm products. Other new items are $65,000 for the gathering of information pertaining to the marketing of live stock and its products and $35,000 for cooperation with the States in marketing studies. An increase from $238,000 to $285,000 is granted for other marketing and distribution studies, notably for additional attention to cooperative purchasing and marketing, market grades and standards, marketing business practice, and the marketing of live stock, meats, animal by-products, dairy products, grain, seeds, and hay. The Office also receives $48,000 to continue the cotton-standardization work and $32,860 for its studies in rural organization.

An increase from $50,000 to $75,000 is provided for the enforcement of the plant-quarantine act by the Federal Horticultural Board. Of this sum $15,000 is to be used to prevent the introduction of the pink bollworm, one of the most serious cotton pests known, and $10,000 for the inspection of imported potatoes to guard against potato wart and other diseases and insect pests.

The work of the remaining branches of the Department is continued on substantially the present basis, both as to funds and lines of work. The Bureau of Crop Estimates receives $316,436, an increase of $32,956, mainly for the employment of additional field agents and specialists, notably in truck and fruit crops. The Office of Public Roads and Rural Engineering is granted $599,200, an increase of $12,735; the Office of the Secretary $688,160, of which $285,810 is for the Office of Farm Management; the Division of Accounts and Disbursements, $44,920; the Division of Publications, $197,650; and the Library, $49,520. The Department is again allotted $105,000 for the enforcement of the insecticide act, $40,000 to continue demonstration work on reclamation projects, and $123,689 for rent of buildings in the District of Columbia, and receives $122,500 for miscellaneous expenses.

Exhibits by the Department are provided for at the International Soil Products Exposition to be held at El Paso, Texas, October 17–26, and at the National Dairy Show at Springfield, Massachusetts, October 12–21, with appropriations of $20,000 and $15,000, respectively. The former exhibit is to be illustrative of farming methods in the subhumid, arid, and semiarid regions of the country, and the latter of the boys' and girls' club work and other features of the extension work carried on in the North Atlantic States. The President is authorized to extend invitations to other nations to participate in the International Farm Congress and the International Irrigation Congress, both of which are to be held at El Paso.

Reference has already been made to the trio of noteworthy measures appended to the main portion of the act and designated respectively as the United States Cotton-Futures Act, the United States Grain-Standards Act, and the United States Warehouse Act. These measures are all designed to alleviate some of the difficulties which have frequently confronted farmers in the marketing of the staple agricultural crops.

The United States Cotton Futures Act, as reenacted, follows substantially the text of the act passed in 1914. That measure, it will be recalled, was a taxing statute designed to regulate future trading in cotton so that it would be fairly conducted and truly reflect the values of spot cotton. It imposed a tax at the rate of two cents per pound on all contracts of sale of cotton for future delivery entered into on exchanges and like institutions, unless such contracts complied with certain conditions which were calculated to eliminate certain recognized evils in future dealings. Among the conditions necessary to be met in order to exempt a contract from the tax were the use of the official cotton standards of the United States established under the act, and of actual commercial differences in the settlement of such contracts as ascertained from actual sales of cotton in bona fide spot markets. The act also taxed orders sent from the United States for the making of future contracts on exchanges in foreign countries, unless the contracts made on the foreign exchanges complied with certain conditions. The Secretary of Agriculture was given authority to establish the official standards, to designate the bona fide spot markets, and to determine disputes referred to him by the parties to future contracts involving the grade, length of staple, or quality of cotton offered for delivery thereunder. The most important changes made in the new act are the omission of the tax on orders sent abroad for the making of future contracts and the addition of authority for the Secretary of Agriculture in settling disputes to include in his findings a complete classification of the cotton involved. The new act became effective Sep-

tember 1, an appropriation of $120,750 and the unexpended balances from appropriations for the previous measure being available for its enforcement.

The United States Grain-Standards Act authorizes the Secretary of Agriculture to investigate the handling and grading of grain, establish official standards, license grain inspectors, and otherwise administer its provisions. After the standards for a grain have become effective, all shipments by grade in interstate or foreign commerce must either be inspected by a licensed inspector at the point of shipment, during transit, or at the point of delivery, or, if there are no inspection facilities available, may be marketed uninspected but subject to the right of either party to the transaction to refer any dispute as to the grade to the Secretary of Agriculture for his determination. An appeal to the Secretary may also be taken as to the true grade of grain which has been inspected. The findings of the Secretary in cases of dispute and appeals are made prima facie evidence in court proceedings.

The certifying of an official grade on shipments subject to Federal supervision is restricted to inspectors holding Federal licenses. These licenses are to be issued to persons authorized to inspect and grade grain under State laws, or may be issued to any competent and disinterested person, and may be suspended or revoked for cause. A complete system of records and reports is required of inspectors, and penalties are provided for false grading, interference with officials, and other violations of the act.

The legislation is designed to facilitate the use of more uniform grades in handling grain, thus simplifying the relations between the producer, dealer, and consumer. Since the final decision as to the grade of a shipment rests with the Department, it is also expected that the grower may more readily obtain higher returns for a product of superior merit, thus supplying him with a financial incentive to improve its quality. An appropriation of $250,000, available until expended, is made for the enforcement of the act.

The central purpose of the United States Warehouse Act is to establish a form of warehouse receipt for cotton, grain, wool, tobacco, and flaxseed which will make these receipts easily and widely negotiable as delivery orders or as collateral for loans, and therefore of definite assistance in financing crops. This purpose the act aims to attain by authorizing the licensing of bonded warehouses under conditions which will insure the integrity of their receipts and make these receipts reliable evidence as to the condition, quality, quantity, and ownership of the products for which they are issued.

The Secretary of Agriculture is given authority to inspect, classify, and license warehouses when found suitable for the storage of these commodities, as well as to establish official standards for them, to

issue licenses to competent persons to classify and weigh the products to be stored in the warehouses, and to conduct warehouse investigations. The system of licensing is entirely voluntary, but provides for Federal licenses, when desired, for warehouses in which cotton, grain, wool, tobacco, and flax may be stored for interstate or foreign commerce, or located in places under the exclusive jurisdiction of the United States, or owned, operated, or leased by any State. Applicants must agree to comply with the act and the rules and regulations prescribed under it and give bond to secure the performance of their obligations. The form of receipt and manner of delivery of products are prescribed in detail, and records and reports are subject to examination by the Department. All grain, flaxseed, or other fungible products stored in these warehouses for interstate or foreign commerce must also be inspected and graded by persons licensed for the purpose. The licenses may be revoked for cause, and penalties are provided for fraudulent transactions. The Warehouse Act became effective at once and carries an appropriation of $50,000, available until expended, for its enforcement.

In a discussion of the appropriation act as a medium for the support of the Department of Agriculture, reference should also be made to the funds administered by it but appropriated in other ways. For the fiscal year under discussion, what are termed the permanent appropriations under the Department will aggregate $10,604,000, the largest items being those of $5,000,000 for the construction of rural post roads under the law recently described (E. S. R., 35, p. 200), of which not to exceed $150,000 may be used by the Department for administering the act; $3,000,000 for meat inspection; and $1,580,000 under the Smith-Lever Extension Act; the remainder being chiefly for payments to the States as their quota of the receipts from the National Forests. There is also the appropriation for the Department printing and binding, carried as usual in the appropriation act for sundry civil expenses. This appropriation has been increased from $500,000 to $600,000, of which $47,000 is for the Weather Bureau and $177,500, an increase of $40,000, for use in the publication of Farmers' Bulletins.

Nor are the Federal appropriations for agricultural purposes confined to the Department of Agriculture. The usual large appropriations will be available for agricultural education in the land-grant colleges under the Morrill and Nelson Acts, as well as the smaller grants for the rural education work of the Bureau of Education, demonstration work among the Indians, and the payment of the country's quota toward the support of the International Institute of Agriculture. The aid granted under the Federal Farm Loan Act

has been already discussed (E. S. R., 35, p. 101). A provision is also carried in the National Defense Act of June 3, 1916, for an investigation of means for the production of nitrates and other products for munitions of war and useful in the manufacture of fertilizers, and for the construction and operation by the Government of a plant or plants to manufacture these products. This enterprise carries an appropriation of $20,000,000.

The substantial aid tendered to agriculture in these various ways indicates anew the increasing popular realization of the responsibility of the Federal Government in the development of the Nation's basic industry. The program of work outlined for the coming months is unusually broad and comprehensive, and extends the functions of the Department in a number of new and important directions. It augments especially its administrative and regulatory powers, but it also provides more liberally than ever before for the development of scientific research and the dissemination of agricultural knowledge. There will be general concurrence in the view expressed by President Wilson, after signing the appropriation act, that it will tend to "result in making agriculture more profitable and country life more comfortable and attractive, and therefore insure the retention in rural districts of an efficient and contented rural population."

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Practical physiological chemistry, P. B. HAWK (*Philadelphia: P. Blakiston's Son & Co., 1916, 5. ed., rev. and enl., pp. XIV+638, pls. 6, figs. 172*).—This is the fifth edition of the volume previously noted (E. S. R., 21, p. 63). The chapters on nucleic acids and nucleoproteins, gastric analysis, intestinal digestion, blood analysis, and metabolism are new and have been inserted to increase the usefulness of the volume and to keep thoroughly abreast with recent developments in physiological chemistry. The latest methods of quantitative analysis have also been introduced throughout the volume. Thirty-five new illustrations have been incorporated.

Yearly report in regard to the progress made in agricultural chemistry, edited by T. DIETRICH and F. MACH (*Jahresber. Agr. Chem., 3. ser., 17 (1914), pp. XXIX+563*).—A report of the work of 1914 in continuation of that previously noted (E. S. R., 34, p. 311).

Report of the committee on editing methods of analysis (*Jour. Assoc. Off. Agr. Chem., 1 (1916), No. 4, pt. 2, pp. 57, figs. 4*).—This report contains the recommendations of the committee on editing methods for official and tentative methods of analysis of fertilizers, soils, inorganic plant constituents, waters, and tanning materials, presented at the annual meeting of the Association of Official Agricultural Chemists, November 16–17, 1915.

On the origin of the humin formed by the acid hydrolysis of proteins, R. A. GORTNER and M. J. BLISH (*Jour. Amer. Chem. Soc., 37 (1915), No. 6, pp. 1630–1636; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 8, p. 1026*).—It has been demonstrated that "in all probability the humin nitrogen of protein hydrolysis has its origin in the tryptophan nucleus." When tryptophan is boiled alone with mineral acids no humin is formed; when protein or carbohydrate is present, however, an abundance is formed. With large amounts of carbohydrate present nearly 90 per cent of the tryptophan nitrogen remains in the humin fraction. Histidin causes no increase of nitrogen in the humin fraction and can be quantitatively recovered in the bases. The humin is probably formed by condensation of an aldehyde (formed by the action of the acid on carbohydrate) with the NH group of the tryptophan nucleus. It is indicated that a distinct value can thus be assigned to the humin nitrogen determinations.

Fractionation of the phosphotungstic-acid precipitate with acetone as a useful method for the preparation of the vitamin fraction from yeast, C. FUNK (*Biochem. Bul., 5 (1916), No. 17, pp. 1–16*).—The author has demonstrated that "the phosphotungstate precipitate from alcohol extract of yeast can be divided, by means of acetone, into two fractions: A small insoluble fraction which contains the bulk of vitamin, and a large soluble one which is totally inactive." Lead acetate was used to decompose the phosphotungstates instead of baryta, as this procedure offered the advantage of yielding clear solutions which facilitated further purification and avoided the use of alkali. From autolyzed yeast an insoluble fraction could be obtained by the acetone method which represented 34 per cent of the total phosphotungstate precipitate.

The molecular weights of certain vegetable oils, H. J. Backer (*Chem. Weekbl., 12 (1915), No. 47, pp. 1034–1040; abs. in Analyst, 41 (1916), No. 479, p. 47*).—The average molecular weights of a number of vegetable oils, calculated from the lowering of the freezing point, are submitted, as follows: Coconut oil 613, cohune nut oil 625, arachis oil 803, cato seed oil 803, cato seed oil (hydrogenated) 884, linseed oil 796, maize oil 796, mustard seed oil 928, olive oil 803, palm kernel oil 644, rape oil 892, castor oils 844 and 1,031, sesame oil 800, and soy-bean oil 783. A commercial sample of blown rape oil showed a molecular weight of 1,335.

Other physical constants of these oils are also given.

Philippine oil-bearing seeds and their properties, H. C. Brill and F. Agcaoili (*Philippine Jour. Sci., Sect. A, 10 (1915), No. 2, pp. 105–121, figs. 2; abs. in Ztschr. Angew. Chem., 29 (1916), No. 18, Referatenteil, p. 114*).—The percentage yields, chemical constants, physiological properties, and commercial possibilities of several Philippine oils have been studied and the results reported in detail.

It has been demonstrated that the oil from the lumbang bato (*Aleurites moluccana*) and lumbang banucalag (*A. trisperma*) are drying oils of high quality, comparing favorably with linseed and Chinese wood oils, while the oil from the nuts of the calumpang, cato (*Chisochiton cumingianus*) kapok, pili, palo maria de la playa (*Calophyllum inophyllum*), and palo maria del monte (*C. wallichianum*) have no appreciable drying qualities.

On the heating of hay during the curing process, F. W. J. Boekhout and J. J. O. de Vries (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 19 (1916), pp. 61–80, fig. 1*).—Analytical data of a number of samples of gas obtained in the curing of hay are submitted in detail.

The heating in the process of curing is largely attributed to a purely chemical action in which iron acts as a catalyzer. Bacteria and enzyms also play an important rôle in the process. Attempts to sterilize the hay with a 2 per cent solution of copper sulphate were unsuccessful, since the growth of yeasts and molds could not be controlled by this treatment. The production of furfurol in the curing of hay, as noted by earlier investigators, was confirmed.

[The nature of the coloring matter of sugar cane], M. A. Schneller (*Louisiana Stas. Rpt. 1915, pp. 13, 14*).—Preliminary results indicate that "substances belonging to the polyphenols are present in cane, especially the eyes and tops, and cause in connection with iron the dark color of juice and sirup. The action of boiling temperatures and sulphur dioxid in the sugar houses results only in a temporary decomposition and reduction of the polyphenol iron compound and decolorization of the products. The darkening of plantation white sugars in storage must be sought in reoxidation of adhering or occluded traces of the iron polyphenol. Decomposition products of a similar nature (glucinic acid) are also formed by the action of lime at alkaline reaction on glucose. Alkalinity is, however, avoided in the white sugar manufacturing in this State. A means of elimination of the polyphenols could be found in the boneblack process, generally discarded as too costly. Elimination of iron by secondary carbonation, or a similar process, has the same result, but would be successful only if further contact of the liquors with iron were completely avoided. Lining of the iron equipment with rust-proof enamel might lead to a distinct improvement.

"The incrusting coloring matter of cane fiber, although perhaps the physiological product of the above-mentioned polyphenols and of a similar chemical composition (coniferin or a derivative), does not yield dark-colored iron com-

pounds and owing to its firm combination with the lignin of the cell walls is only separated with difficulty and would not easily pass into the juice."

Studies on the relation of cement dust to citrus vegetation.—I, The effect on photosynthesis, H. D. Young (*Biochem. Bul., 5 (1916), No. 18–19, pp. 95–100*).—The investigation has shown that the coating of dust on orange leaves adjacent to cement plants amounted in many cases to as much as 0.0034 gm. per square centimeter and corresponded in composition very closely to the "raw mixture" from which the cement was made. The amount of dust found on such leaves may shut out as much as 80 per cent of light from the upper surface of the leaf. This exclusion of light, however, does not interfere with the carbohydrate synthesis. The metabolic activity of new leaves was only slightly greater than that of old leaves.

Researches on arginase; concerning the action of arginase on creatin, A. Clementi (*Atti R. Acad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 5, pp. 483–489*).—It has been demonstrated that creatin is not hydrolyzed into urea and sarcosin by arginase, thus confirming the previous finding of Dakin.[a] Arginase is not a ferment capable of detaching the guanidin nucleus from any compound to which it may be bound, as would be indicated by the name "deguanidase," which has recently been proposed. The inability of arginase to hydrolyze creatin supports the contention of the specificity of the enzym.

Adsorption of invertase, J. M. Nelson and E. C. Griffin (*Jour. Amer. Chem. Soc., 38 (1916), No. 5, pp. 1109–1115*).—From the investigation it is concluded "that invertase is colloidal in nature, and the reaction between the enzym and cane-sugar solution depends on the contact of two phases. The activity of invertase . . . is not affected whether or not the enzym is adsorbed to a solid like charcoal, or to a colloid like saponin, serum, or egg albumin, distributed uniformly throughout the solution of the substrate. Displacing the adsorbed invertase by a second colloid is without effect on the activity, contrary to the views held by many. Invertase can be removed from an aqueous solution by adsorption to a solid, and again brought into solution by a second colloid suspended uniformly throughout the solution. Eriksson's proof that cane sugar can liberate invertase adsorbed to charcoal is not valid."

The experimental methods used were those described in the communication previously noted (E. S. R., 34, p. 803).

The occurrence of urease in higher plants, M. W. Beijerinck (*Chem. Weekbl., 13 (1916), No. 16, pp. 443, 444*).—The author has found urease in the cortex of the twigs and in the buds of *Glycine sinensis* and *Cytisus laburnum*. The seeds of the latter were especially rich in urease, although considerably less was found than is present in the soy bean. Its presence was also demonstrated in the bark of the ordinary acacia, *Robinia pseudacacia*, in the seeds of the indigo plant, and in the tissues of the various herbaceous Papilionaceæ. Its presence could not be determined in peas, beans, flaxseed, almonds, and various other plants examined.

A simple device for regulating the pump used in exhausting a vacuum oven, G. P. Plaisance and D. V. Moses (*Jour. Amer. Chem. Soc., 38 (1916), No. 5, pp. 1063–1065, fig. 1*).—The authors describe in detail a simple automatic device for maintaining any desired pressure in a Freas electrically heated vacuum oven. The apparatus is easily assembled and has given entire satisfaction.

A new form of gas burette, Hammermann (*Chem. Ztg., 40 (1916), No. 10–11, p. 84, fig. 1*).—An apparatus to measure gases only slightly soluble in water, in

[a] Jour. Biol. Chem., 3 (1907), No. 5, pp. 435–441.

which the burette and leveling bulb are mounted together on a Woulff bottle, and its manipulation are described in detail.

A simple, efficient, and economic filter, S. L. Jodidi and E. H. Kellogg (*Biochem. Bul., 5 (1916), No. 18–19, pp. 87–94*).—The authors describe in detail the preparation and use of the paper pulp filter and demonstrate its efficiency by submitting analytical data. Its application to the filtration of the ammonium-phosphomolybdate precipitate in phosphorus determinations is especially indicated.

See also previous notes (E. S. R., 34, p. 712; 35, p. 204).

A modification of the Lunge nitrometer, W. Senften (*Chem. Ztg., 40 (1916), No. 4–5, pp. 39, 40, figs. 2*).—A modified apparatus, which shortens the time for making determinations by insuring the complete solution of the sample, and its manipulation are described in detail. A new gas burette for use in connection with the apparatus is also described.

The quantitative determination of silica, V. Lenher and E. Truog (*Jour. Amer. Chem. Soc., 38 (1916), No. 5, pp. 1050–1063*).—After preliminary experiments on the various factors which influence the solubility of silica the following procedure was adopted:

A 0.5 to 1 gm. sample is intimately mixed with 5 gm. of sodium carbonate and fused in a platinum crucible. The cold fusion is treated with 60 cc. of hydrochloric acid (specific gravity 1.07). After all carbonates are decomposed the solution is evaporated on the water bath until the residue begins to crumble. The residue is treated with 15 cc. of hydrochloric acid (specific gravity 1.1), covered, and heated on the water bath for ten minutes. After diluting with 10 cc. of water it is filtered and the silica washed with a hot solution consisting of 5 cc. of hydrochloric acid (specific gravity 1.2) to 95 cc. of water. The filtrate is evaporated to dryness, the residue dehydrated at 110° C. for two hours, taken up with 8 cc. of hydrochloric acid (specific gravity 1.1), covered and heated on the water bath from five to ten minutes, diluted to 50 cc., and filtered immediately, washing with cold water containing 1 cc. concentrated hydrochloric acid to 99 cc. of water. The two portions of silica thus obtained are carefully ignited to constant weight in a platinum crucible and the silica determined by volatilization with hydrofluoric acid after the addition of a few drops of sulphuric acid.

It is indicated that in the sodium-carbonate fusion methods for silicates there is always a nonvolatile residue which contains the various bases and which should be fused again with sodium carbonate and added to the filtrate from the silica when the bases are to be determined.

Dehydrated silica is appreciably soluble in hydrochloric acid of all strengths. This error is, however, negligible when dilute acid is used. The dehydration temperature should be kept below 110°. Excessive amounts of sodium carbonate should be avoided in the fusion, since the subsequently formed sodium chlorid exerts a solvent action on the silica.

Comparative tests of certain methods for the determination of copper in copper sulphate, von Wissell and F. Küspert (*Landw. Vers. Stat., 86 (1915), No. 3–4, pp. 277–286*).—As a result of the comparison of the various methods used for the determination of copper in fungicidal materials in the presence of iron the thiocyanate procedure was found to yield reliable results and to be the simplest and most economical of all the methods tried, especially where only occasional determinations are necessary.

The Grete volumetric method for the determination of phosphorus in fertilizers, G. Incze (*Kisérlet. Közlem., 18 (1915), No. 5–6, pp. 797–809*).—From a critical examination of the method the author has found that the proper prep-

aration of the reagent used in this method is very important, particularly the preparation of the glue solution. The presence of hydrochloric acid, large amounts of iron, and, especially, organic substances influence the correctness of the titration. The water-soluble phosphoric acid in superphosphates and that obtained from Thomas slag by digestion with sulphuric acid can be determined directly after neutralizing the solution. The procedure is applicable to routine analyses, but is not recommended on account of the care and patience required in its manipulation. The accuracy of the method is indicated by submitted experimental data.

The volumetric determination of potassium and its application in the analysis of fertilizers, G. Ajon (*Ann. R. Staz. Sper. Agrum. e Frutticol. Acireale, 3 (1915), pp. 91–104*).—The procedure described by the author is as follows:

About 25 cc. of a 2 per cent solution of potassium chlorid or potassium sulphate, or an amount equivalent to from 1.08 to 1.26 per cent of potassium oxid, is transferred to a 150–200 cc. Erlenmeyer flask, 50 cc. twice-normal tartaric acid added, and the mixture thoroughly shaken. Twenty-five cc. of half-normal sodium hydroxid is then added and the mixture again strongly agitated for five minutes. To this 25 cc. of 96 per cent alcohol are added and the flask and contents allowed to stand for from six to eight hours. The precipitate thus formed is washed by decantation several times and finally transferred to the filter, where it is thoroughly washed with neutral 96 per cent alcohol. It is then treated with tenth-normal alcoholic sodium hydroxid until strongly alkaline to phenolphthalein, and allowed to set for about five minutes with occasional shaking. When the precipitate is completely dissolved the amount of tenth-normal hydroxid used is determined by titration with standard hydrochloric acid.

The number of cubic centimeters of tenth-normal sodium hydroxid used to dissolve the bitartrate, multiplied by 0.00471, gives the amount of K_2O present in the original solution. Analytical data submitted indicate the accuracy of the method.

The use of enzyms and special yeasts in carbohydrate analysis, W. A. Davis (*Internat. Sugar Jour., 18 (1916), No. 208, pp. 166–171*).—This material has been previously noted from another source (E. S. R., 35, p. 206).

The possibility of titrating the monosubstituted amino group of amino acids with formol, A. Clementi (*Atti R. Acad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 4, pp. 352–359; Arch. Farmacol. Sper. e Sci. Aff., 21 (1916), No. 6, pp. 215–224; abs. in Chem. Abs., 9 (1915), No 17, p. 2394*).—The Sörensen formol titration method for the determination of the quantity of amino groups in amino acids has not as yet been applied to amino acids in which the amino group is partly or completely substituted. The author has performed experiments of this kind with sarcosin, and shows that the amino group, even if monosubstituted, reacts with formaldehyde. In titrating monosubstituted amino acids according to Sörensen's method it is, however, necessary to titrate to the intense coloration of phenolphthalein, as otherwise the results will be slightly too low.

Concerning the protein content of meat, N. W. Janney (*Proc. Soc. Expt. Biol. and Med., 13 (1916), No. 5, pp. 83, 84*).—The author indicates the error inherent in the protein determinations in meat because of the large amount of nonprotein nitrogen present. The average nitrogen content of meat proteins lies between 16.2 and 16.7 per cent, and is not 16 as the factor 6.25 commonly used indicates. The principle involved in a modified procedure for the direct determination of the proteins in muscle is the coagulation of the muscle in alcohol and the removal of nonprotein material by extraction. With proper precau-

tions it is possible to separate completely the fatty and other nonprotein material from the proteins so that they can be obtained in a high state of purity.

Analytical data of the protein content of dog, rabbit, chicken, and fish (halibut) muscle are included.

The rapid analysis of milk, G. PÉGURIER (*Ann. Chim. Analyt., 21 (1916), No. 4, pp. 70–73, fig. 1*).—The author describes rapid procedures for the determination of the specific gravity, fat, and lactose, to be used in the field for ascertaining the purity and food value of milk. The specific gravity is determined in the usual manner; the fat in an ordinary or a specially graduated test tube, by extraction with an alcohol-ether mixture after the addition of a few drops of alkali; and the lactose by Fehling's solution, after precipitation of the protein with a reagent composed of phenol and acetic and citric acids in 95 per cent alcohol.

Note on human milk, G. D. ELSDON (*Analyst, 41 (1916), No. 480, p. 74*).—The following figures, obtained from 67 complete analyses representing the average percentage composition of human milk, are submitted: Total solids 11.7, protein 1.19, fat 3.11, ash 0.21, solids-not-fat 8.59, and lactose 7.18 per cent. In 79 other samples the total solids averaged 11.78, fat 3.28, and solids-not-fat 8.5 per cent.

[Methods of direct sucrose determinations in the presence of reducing sugars], M. A. SCHNELLER (*Louisiana Stas. Rpt. 1915, p. 14*).—In the methods based on the action of small amounts of alkali on the rotary power of the reducing sugars several sources of error were found to be inherent, which are summarized as follows: "(1) The residuary levorotation introduces a considerable error, especially with material high in reducing sugar and with methods using a weak concentration of alkali. (2) Stronger concentrations of alkali reduce this levorotation but introduce a second serious error due to the decrease of sucrose rotation by the neutralized alkali. (3) The incidental use of oxidants (as hydrogen peroxid) also causes a destruction of sucrose. Apparently correct results are possible by compensation of errors due to (1) and (3)."

Studies on the analysis and analytical products of glucose, T. VAN DER LINDEN (*Arch. Suikerindus. Nederland. Indie, 23 (1915), No. 52, pp. 1979–1994; Meded. Proefstat. Java-Suikerindus., 5 (1915), No. 22, pp. 609–624*).—In the analysis of invert sugar by barium or calcium hydroxids at 80° C. the author has obtained appreciable amounts of saccharic and gluconic acid, together with a small amount of oxalic acid. Formic acid was also formed, but the presence of lactic acid could not be determined. The acids were isolated in a pure form by precipitation with neutral, basic, or ammoniacal lead acetate. The experimental procedures used in the work are described in detail.

The American Leather Chemists Association, 1916 (*Amer. Leather Chem. Assoc. [By-laws, etc.], 1916, pp. 37*).—This pamphlet outlines in detail the official methods for the analysis of vegetable materials containing tannin, for sampling tanning materials, and for leather analysis. Provisional methods for the analysis of sulphonated oils, moellons, and hard greases are also included.

[Report of the] bacteriological department, W. L. OWEN (*Louisiana Stas. Rpt. 1915, pp. 11–13*).—From results obtained in a study of the deterioration of sugars, and the principal factors affecting it, "it appears that neither the moisture alone, nor when used in conjunction with the factor of safety, furnishes a reliable criterion of the keeping quality of a sugar, but that its degree of infection must also be taken into consideration."

In a study of the species of micro-organisms causing deterioration of sugar, 18 cultures of bacteria and 20 cultures of yeast were obtained from sugar. "There appears to be considerable variation in the deteriorative power of the

different species, which is not altogether obliterated by repeated cultivations. Sugars from widely distant countries show no greater variation in this respect than sugar from adjoining plantations. . . . It was observed that the micro-organisms found in sugars do not predominate either in the mill juice or on the cane leaves. Analyses showed these sugar deteriorative forms to occur only to the extent of 19.5 per cent in the fresh juice. From this point they increase to 46 per cent and 91.5 per cent in the sulphured and defecated juice, respectively. The filter press appears to be the vital point in determining the infection of the finished sugars."

A distinct and hitherto undescribed species of bacteria, commonly occurring in the interior of borer-infested cane, was isolated and named *Bacterium saccharum officinarum*. "Inoculation experiments upon cane showed . . . that it is not a great factor in the deterioration of the juice of the growing cane, hence its presence there does not apparently aggravate the deterioration following borer infestation."

The products of the farm slaughterhouse, sausage kitchen, and smoke house, A. HARING and W. HISLOP (*State Col. Wash., Dept. Ext. Bul. 10 (1916), pp. 23, figs. 6*).—This pamphlet discusses the slaughtering of beef cattle, veal, sheep, goats, and hogs, and outlines the methods in use for the curing and smoking of meats. Directions for the preparation of various kinds of sausage, lard, soap grease, and tripe, together with a list of tools for the farm slaughterhouse, are included.

Forest chemistry, PURAN SINGH (*Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 10–21*).—These pages contain brief comments on minor products distilled from the deodar and their value and uses, the optical rotation of steam-distilled deodar oil, the dry distillation of deodar, the best season for collecting myrobalans as a tannin material, an inquiry as to the possibility of reducing the harshness of tan barks, the manufacture of products from *Boswellia serrata* and their chemical composition, Indian sumac, use of nickel hydroxid in tannin estimation, camphor in dried camphor leaves, the camphor content of the various parts of a camphor tree, and the determination of moisture in fresh camphor.

The conifer leaf oil industry, A. W. SCHORGER (*Metallurg. and Chem. Engin., 14 (1916), No. 9, pp. 515–518, figs. 4*).—This article discusses the conifer leaf oil industry and describes the still and its operation. Certain factors which influence the yield of oil are indicated.

A table giving the yield of oil, specific gravity, and principal constituents of a number of the conifer leaf oils is submitted.

METEOROLOGY.

Illusions of the upper air, N. SHAW (*Nature [London], 97 (1916), Nos. 2426, pp. 191–194; 2427, pp. 210–214, figs. 3*).—This is a brief review of progress in meteorological theory in England since 1866, showing how the development of upper air research has modified commonly accepted views regarding the atmosphere in general, especially the conception of cyclones and anticyclones, the convection theory, and the general structure of the atmosphere. It is stated that the principal result of this study of the upper air "is the division of the atmosphere into two layers: A lower layer about 10 km. thick, the troposphere, the region of convection; and an upper layer, the stratosphere, in which there is no convection. We can use the information to test some of the generally accepted ideas about cyclones and anticyclones by comparing the results of speculation with the new facts. Many of the pictures which we imagined now appear to have been illusions. Those of us, for example, who thought that because the air was warmed from the bottom, the upper part

would be free from sudden changes of temperature such as we get at the surface were rapidly and rudely disappointed. Simplicity is not apparently the characteristic of the upper air."

Night cooling and the importance of the dew and frost points, J. SCHUBERT (*Met. Ztschr., 32 (1915), No. 8, pp. 343–350, figs. 3*).—The observations of various investigators bearing on the relations of the temperature of the surface of the earth and the overlying air, and of the pressure and humidity of the air, to the formation of dew and frost are critically reviewed and discussed in this article.

The following are among the conclusions reached from the data cited:

With a given pressure, the frost-point is higher than the dew-point. The frost-point T*e* may be calculated from the dew-point T within 0.1° by the formula T*e*=0.9T. For more accurate reckoning for temperatures from 0 to —14° the factor 0.89 should be used. The dew-point runs parallel with the air temperature from midnight to 6 a. m. The surface temperature falls more rapidly than that of the overlying air and may be below the dew-point while the overlying air is still above. Dew begins to form with a humidity of 90 per cent, is greater at 95 per cent, and turns to fog at 99 per cent. The formation of dew results in a distinct lowering of pressure. During the last half of the night the fall of temperature is relatively less with formation of dew and frost than with dry air, due to heat set free by condensation.

Frost protection for fruit and vegetables in the United States (*Abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No 1, pp. 36–42*).—This is a summary of a number of papers on this subject, most of which have been separately noted in the *Record.*

The weather of 1915, J. A. MURRAY (*Rpt. Agr. New Brunswick, 1915, pp. 161–169*).—Observations on temperature, precipitation, and sunshine at Fredericton, N. B., and on temperature at various other places in the Province are tabulated and briefly discussed. The season of 1915 was unusual and unfavorable for farming mainly on account of excessive precipitation and diminished sunshine.

The weather of the past agricultural year, F. J. BRODIE (*Jour. Roy. Agr. Soc. England, 76 (1915), pp. 171–180*).—The weather conditions throughout the British Isles during 1915 are summarized as usual and comparisons made with the weather of previous years. It is stated that as a result of a succession of adverse weather influences the yield of crops during the year was generally below the average.

Hailstorms and hail prevention during 1915 in the departments of Gironde and Dordogne, France, A. ANGOT (*Compt. Rend. Acad. Agr. France, 2 (1916), No. 20, p. 558*).—This is a brief note on a more detailed report by F. Courty in a bulletin of the Meteorological Commission, the principal conclusion of which is that hailstorms are always irregular in occurrence and distribution, and that the electric tower method of prevention apparently exerts no practical influence on their course or intensity.

Annual distribution of cloudiness in France, G. BIGOURDAN (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 17, pp. 620–625, figs. 13; abs. in Rev. Sci. [Paris], 54 (1916), I, No. 9, p. 285*).—This is a report of a complete study for France similar to that which has been undertaken by Teisserenc de Bort for the whole world. Curves, isonèph, connecting points of equal mean monthly cloudiness are given and discussed. Attention is called to the need for this purpose of longer series of observations at a greater number of places.

International catalogue of scientific literature. F—Meteorology (*Internat. Cat. Sci. Lit., 12 (1915), pp. VIII+194*).—"The literature indexed is mainly that of 1912, but includes those portions of the literature of 1901–1911 in regard

to which the index slips were received by the Central Bureau too late for inclusion in the previous volumes. There are also entries dated 1913." The section on the relation of climate to agriculture contains 18 references, that on phenology 8.

SOILS—FERTILIZERS.

Soils courses at the Iowa State College, P. E. Brown (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 42–47*).—The soils courses at the Iowa State College are briefly outlined and discussed, the five distinct groups now recognized being soil physics, soil fertility, soil bacteriology, soil surveying, and soil management.

Mechanical study of soil, D. J. Hissink (*Indische Mercuur, 38 (1915), No. 47, pp. 975–977*).—This is a general statement of the present status of the mechanical classification of soils.

The colloids of clay and humus soils, P. Rohland (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 8–9, pp. 360–367*).—This is a second brief contribution to the subject (E. S. R., 32, p. 318).

Experiments on water holding in vegetation pots, P. Ehrenberg, F. Bahr, and O. Nolte (*Jour. Landw., 63 (1915), No. 3, pp. 199–225*).—Pot culture experiments with corn in sand to test the relative values of various substances for increasing the water-holding capacity of sand in pot culture experiments are reported. The pots contained about 15 kg. of sand; and emery, pulverized glass, and barium sulphate were added in 1 kg. amounts; kieselguhr, artificial zeolite, and clay in amounts of ½ kg.; and peat dust ¼ kg.

The results are taken to indicate that of the materials tested barium sulphate may be used to the best advantage for increasing the water-holding power of sand in sand cultures. Under certain conditions kieselguhr may be used, but emery only in special cases. Powdered glass, artificial glass, clay, and peat are considered unsuited for general use for this purpose.

Miscellaneous samples, soils, L. Heimburger (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 1, pp. 167–174*).—This section of the report contains the results of analyses of 21 samples of Florida muck, rock, and calcareous, sandy, forest, and humus soils.

Soil survey of Elkhart County, Indiana, G. B. Jones and R. S. Hesler (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 28, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Department of Geology and issued May 25, 1916, deals with the soils of an area of 295,680 acres in northern Indiana, the topography of which is characteristic of a glaciated region and varies from flat to hilly. The soils are of glacial origin and are grouped as upland and sand-plains soils. Exclusive of muck, peat, and meadow, eleven soil types of four series are mapped, of which the Miami loam, Plainfield sandy loam, and Miami sandy loam cover 37, 27, and 12.5 per cent of the area, respectively.

Soil survey of Lafayette Parish, Louisiana, A. H. Meyer and N. M. Kirk (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 32, fig. 1, map 1*).—This survey was issued May 22, 1916, and deals with the soils of an area of 176,640 acres in southern Louisiana which lies mostly in the coastal prairie region of the Gulf Coastal Plain province. "By far the greater portion consists of the uplands, or terrace, the surface of which is, for the most part, practically level." In general the drainage is fairly good.

The soils are grouped as upland and first bottom. Excluding muck and swamp, ten soil types of nine series are mapped of which the Oliver, Lintonia, and Crowley silt loams cover 38.6, 25.6, and 11 per cent of the area, respectively.

Soil survey of Ramsey County, Minnesota, W. G. SMITH and N. M. KIRK (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 37, figs. 2, map 1*).—This survey, issued May 17, 1916, deals with the soils of an area of 103,040 acres in east-central Minnesota, the surface of which is hilly with intervening areas of level to rolling lands. Drainage is incompletely established over a large part of the county.

The soils are directly or indirectly of glacial origin and are predominantly loams. Including marsh and rock outcrop, 18 soil types of 10 series are mapped, of which the Gloucester loam, Merrimac loamy fine sand, Miami loam, Merrimac loam, and marsh cover, respectively, 16.1, 13.7, 11.3, 11.2, and 10.6 per cent of the area.

Report on the soils of Fiji, I, C. H. WRIGHT (*Dept. Agr. Fiji Bul. 9 (1916), pp. 22*).—Analyses of two samples of banana soil from Nasinu, three samples of coconut soil from Laucala, two samples of red and two samples of black " soapstone " soil from Suva, four samples of alluvial soil from Navua, and one sample of banana soil from Galoa and one sample of swamp soil from Qaraniqio are reported, together with appendixes giving instructions for taking official and private samples of soil for analysis and instructions for mechanical analysis.

Some Johore soils, J. GRANTHAM (*Agr. Bul. Fed. Malay States, 4 (1916), No. 4, pp. 114–121*).—Mechanical and chemical analyses of five samples of rubber soils from Johore Bharu, 11 samples of rubber and three samples of coconut soils from Muar, and seven samples of rubber soils from Batu Anam, in Johore, Federated Malay States, are reported.

Studies on nitrogen fixation and Azotobacter forms in soils of foreign countries, C. B. LIPMAN and P. S. BURGESS (*Centbl. Bakt. [etc.], 2. Abt., 44 (1915), No. 17–23, pp. 481–511, pl. 1*).—Studies of the nonsymbiotic nitrogen-fixing flora, especially those of the Azotobacter group, and of the nitrogen-fixing powers of the mixed soil flora of 46 soils from Egypt, India, Japan, China, Syria, the Hawaiian Islands, Guatemala, Costa Rica, Spain, Italy, Russia, Mexico, Asia Minor, Canada, Unalaska, Samoa, Australia, Tahiti, Belgium, Queensland, and the Galapagos Islands are reported.

The plan of experiment " consisted in studying the appearance of the cultures obtained from soil inoculation into [Lipman's mannite solution], making a microscopic study of the mixed flora, isolating pure cultures from the mixed flora plated out on mannite agar, studying the morphology of these, and determining the nitrogen-fixing powers in both solutions and soils of those forms which, selected from the large number of pure cultures, were distinctly different from one another."

It was found in the mixed culture experiments that only about one-third of the soils tested contained Azotobacter. "A fixation of 5 mg. of nitrogen per gram of mannite or over occurred in only 20 out of 40 soils. In 16 of these 20 soils Azotobacter organisms were found. . . . Soils from the Mediterranean region when compared with soils from all parts of the world manifest very high nitrogen-fixing powers in mannite solution and bear a vigorous Azotobacter flora. Many of the soils studied had been previously dried in stoppered museum bottles for periods varying from 5 to 20 years, but still manifested vigorous powers at nitrogen fixation. The latter was in many cases as high as and in some much higher than that of many freshly collected soils known to possess notable powers in that direction."

Usually a high nitrogen content seemed to be unfavorable to vigorous nitrogen fixation, although the highest nitrogen fixation of the 46 soils tested was obtained with a soil containing about 0.3 per cent nitrogen. " It is more generally true that high fixations of nitrogen are accomplished by soils in mannite solutions only when Azotobacter organisms form a part of the same flora. . . .

"Many different forms of Azotobacter were observed in those soils possessing that group of organisms. Very frequently one soil showed the presence of two or three different species of Azotobacter. *A. chroococcum,* however, was the most prominent of all the species and was found most widely distributed in the several soils.

"In a number of cases the amount of pigment produced by the Azotobacter forms was most marked. The organism surpassing all others studied in this respect was a form of *A. chroococcum* in the poor soil from Sinaloa, Mexico.

"Only about half the soils tested showed notable or vigorous gas formation in mannite solution. Only three of these contained Azotobacter organisms. Sixteen of them were the highly ferruginous and humus soils obtained from various portions of the Hawaiian Islands. Gas formation in mannite solutions inoculated with soil would, therefore, seem to be largely accomplished by clostridium and other rod forms and not by Azotobacter. . . .

"Pigment production by cultures ran almost entirely parallel with Azotobacter development in them. Thus the total number of cultures producing pigment was 20, only slightly in excess of the number showing Azotobacter organisms. Of these 20 all but two gave a brown to black pigment. The other two gave a yellow to orange pigment. Twenty-five of the mixed cultures exhibited more or less membrane formation. In nearly all cases the presence of membranes was due to Azotobacter development."

In pure culture studies in mannite solution and sandy soil it was found that on the whole the sandy soil was far superior to the solution as a medium for nitrogen fixation by the several forms of Azotobacter studied, since 17 out of 20 organisms added to the soil in every case more than 3 mg. of nitrogen. The latter was accomplished by only 11 organisms in the case of the mannite solutions. Sixteen out of 20 organisms fixed in every case more than 5 mg. of nitrogen per gram of mannite in the soil as a medium, whereas there were but four such in the case of the mannite solution cultures. There were nearly five times as many of the same organisms which fix 6 mg. or more of nitrogen in the soil culture as there were in the case of the solution cultures.

Studies of the relation of soil type to nitrogen fixation by pure cultures of two types of Azotobacter showed that the fixation of nitrogen by the two organisms tested was notably smaller in the soils which were their natural habitat than in a totally different type of soil. It is concluded "that the soil type . . . is the determinant above all other factors of an organism's power to fix atmospheric nitrogen."

It was further found that considerable difference existed between the powers of different organisms to use certain carbon compounds in nitrogen fixation.

A final study with 56 soils showed the absence of any general law regulating the ratio of nitrogen present in soils to nitrogen fixation by those soils.

Nitrification and total nitrogen as affected by crops, fertilizers, and copper sulphate, C. A. JENSEN (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 10–22; abs. in Chem. Abs., 10 (1916), No. 6, pp. 795, 796*).—Studies on the changes in nitrification and total nitrogen content of soils under field conditions at Rocky Ford, Colo., during the summers of 1911 and 1912, and on the influence of different cropping and fertilizer treatments on excessive nitrate accumulation in these soils, are reported.

It was found that "the accumulation of nitrates in the soils in the Arkansas River Valley in Colorado . . . in 1910 and 1911 . . . became less in 1912 and 1913. In the work in 1911 mustard appeared to have some effect in checking the accumulation of nitrate in the field. Copper sulphate at the rate of 100 lbs. per acre on fallow was also effective in checking nitrification, reducing the average seasonal accumulation to about 60 per cent of the amount found in

the check plat. Molasses on fallow decreased nitrification about 25 per cent . . . but the molasses-treated plat showed a little more nitrates than the plats cropped to cane and oats. Manure on fallow gave a slightly higher accumulation of nitrates than the fallow check. Waste lime on fallow caused strong nitrate accumulation, being more effective in this regard than any other treatment. In general, active nitrification did not set in until the first part of June. From then until the middle of July it was strongest, and then suddenly decreased and became very feeble until the end of the experiment, August 17, regardless of the field treatments. . . .

"The mustard plat contained less total nitrogen than any of the others. The fallow plats receiving copper sulphate and molasses contained less total nitrogen than the other fallow plats. The fallow plats with waste lime and manure each contained less total nitrogen than the plat fallowed with nothing added. The reverse was true as regards nitrates. In general, there seemed to be an inverse relation between the amounts of nitrates and amounts of total nitrogen. In the work in 1912, in the presence of a vigorously growing beet crop, the only treatments which showed decided increases in nitrification were cyanamid and manure plus ammonium sulphate. Aside from considerable weekly variations, there was not much change in nitrification from the middle of May till the latter part of July, after which the nitrifying activity was very low and remained so until the end of the experiment, August 26.

"Bone meal, superphosphate, waste lime, and dry yard manure decreased the nitrifying activity. Composted manure produced a slightly higher nitrifying activity than did the dry yard manure, but both these plats showed slightly less nitrates than the checks. The total organic nitrogen in the first foot showed a general decrease from the latter part of May to the latter part of August. . . . This decrease was least from the middle of June to the middle of July. There was also a slight loss of organic nitrogen from the second foot during the same period. It is shown that the seasonal loss of organic nitrogen could not be accounted for by the amounts removed in the crop. No correlation could be established between the nitrate content and the total nitrogen. Taking into account the nitrogen applied in the manures and lime, the manured plats lost the most nitrogen, especially those to which ammonium sulphate was added, while the limed plats showed a gain in total nitrogen. The plats receiving cyanamid, phosphatic fertilizers, and nitrate showed a slight gain in total nitrogen over the checks. The total nitrogen content in the second foot was unaffected by the fertilizers applied in the first foot. The nitrifying activity in the second foot was very low."

The use of nodule bacteria for legumes, G. Köck (*Die Verwendung von Knöllchenbakterien zu Leguminosen. Vienna: Mitt. Pflanzenschutz Stat., [1915], pp. 4, fig. 1*).—Several different experiments on the inoculation of serradella and lupine crops with nodule bacteria are briefly reviewed, the results of which indicated that the serradella usually responded more markedly to treatment than did lupines. The existence of an after-effect of inoculation of the soil was not established. Differences were observed in the results obtained with different types of bacterial culture. It is thought that inoculation is of great importance for certain legumes under German conditions, but that much depends on the condition of the soil and other environmental factors, thus making tests of the process by each farmer advisable to establish its value in a locality.

Recent investigations on the production of plant food in the soil, I, E. J. Russell (*Jour. Roy. Hort. Soc., 41 (1915), No. 2, pp. 173–187, figs. 2*).—This lecture deals with the physical, chemical, and biological processes involved in

the formation of substances which the plant takes from the soil and utilizes in building up its tissue.

Manurial experiments, G. K. KELKAR (*Dept. Agr. Bombay, Ann. Rpt. Expt. Work Surat Agr. Sta., 1913–14, pp. 23–31*).—Six years' fertilizer experiments with cotton and sorghum are summarized, the results of which are taken to indicate that barnyard manure may well be replaced by rotted cactus, poudrette, tank mud, town sweepings, and mowra refuse.

Experiments with cotton and sorghum on the residual effect of night soil showed that ten years after application superior results were still obtained. Experiments conducted since 1911 comparing the fertilizing value of night soil and poudrette for cotton and sorghum gave results generally in favor of the night soil. Experiments conducted since 1908 to compare the fertilizing values of sodium nitrate, calcium nitrate, ammonium sulphate, calcium cyanamid, and barnyard manure, when applied to cotton and sorghum at the rate of 10 lbs. of nitrogen per acre, showed that for cotton sodium nitrate and calcium nitrate gave the best results, while for sorghum ammonium sulphate and the other artificial fertilizers gave as good results as sodium nitrate.

Experiments with cotton comparing the fertilizing value of a combination of 80 lbs. of calcium nitrate and 160 lbs. of superphosphate per acre, with and without 2.4 tons of barnyard manure per acre, and with barnyard manure alone applied at the rate of 8 tons per acre, showed that the best results were obtained with the combination of artificial fertilizers without manure. The results with manure alone and with manure and the artificial mixture were approximately equal.

Experiments with cotton and sorghum showed that neither of these crops responded to nitrogenous, phosphatic, or potash fertilization on black cotton soil. Experiments with cotton and sorghum comparing barnyard manure alone, used at the rate of 3 tons per acre, and a combination of 60 lbs. of ammonium sulphate, 224 lbs. of superphosphate, and 1.5 tons of manure per acre with and without 80 lbs. of potassium chlorid per acre, showed that the best results were obtained with cotton with the mixture without potash. The difference in results obtained with the mixture with potash and with manure alone was slight.

Report on field fertilizer experiments at the Bernau moor cultivation station, A. BAUMANN and H. PAUL (*Mitt. Deut. Landw. Gesell., 30 (1915), Nos. 42, pp. 627–630; 43, pp. 651–653; 45, pp. 686–688*).—The classified results of four years' experiments with nitrogenous, phosphatic, and potash fertilizers, stable manure, green manure, and lime on an upland moor soil deficient in both nutritive constituents and lime are reported. The cropping system consisted of potatoes, followed in the third or fourth year by rye, which was then followed by meadow or pasture.

A half-and-half mixture of 40 per cent potash salt and potassium-magnesium sulphate was the best potash fertilizer used, giving even better resutls than the 40 per cent potash salt alone. Phonolite meal was unsuitable as a potash fertilizer for this soil. Wolters sodium phosphate gave on the average the best results of the phosphates used, being better than bone precipitate. Of the nitrogenous fertilizers used, sodium nitrate gave the best results, followed in order by calcium nitrate, lime nitrogen, and ammonium sulphate. Of these, ammonium sulphate produced the greatest increase in the starch content of potatoes.

Stable manure used at rates of 300 and 400 kg. per hectare (267 and 356 lbs. per acre) produced greater crop increases than smaller applications of 200 to 300 kg. per hectare. The increases were small, however, as compared to those

by sodium nitrate, and the influence on starch content was not very marked. In the green manuring experiments the best results were obtained when the green matter and roots were used together with sodium nitrate. Better results were obtained with green matter and roots together than with green matter or roots used with sodium nitrate. Liming produced generally favorable results in these soils, although nitrogen assimilation and the starch content of crops were not markedly influenced. The starch content of potatoes was higher when lime was used alone than when used with a basal fertilizer.

Pot culture experiments, 1914, J. A. Voelcker (*Jour. Roy. Agr. Soc. England, 75 (1914), pp. 306–322, pls. 6; Woburn Expt. Sta. Rpt. 1914, pp. 23–39, pls. 6; abs. in Jour. Bd. Agr. [London], 22 (1915), No. 4, pp. 353, 354*).—Experiments on the influence of sulphate, phosphate, carbonate, nitrate, and arsenite of copper on wheat in a relatively rich soil are reported. The results are taken to indicate that sulphate of copper has an injurious effect when used in a quantity supplying 0.05 per cent of copper or more, but that 0.02 per cent of copper or less can safely be used in this form and has a slightly stimulating effect. Phosphate of copper has a generally stimulating influence and can be used in quantities supplying up to 0.1 per cent of copper without producing any toxic effect on the plant. Carbonate of copper is nearly as harmful as sulphate of copper when used in quantities approaching 0.1 per cent of copper. With 0.05 per cent the effect is doubtful, but 0.02 per cent or less has, when used in the form of carbonate, a stimulating influence. Nitrate of copper when supplying 0.02 per cent of copper or more is distinctly harmful, but when used in less amounts has a stimulating influence. Arsenite of copper is very harmful, and even so small a quantity as 0.05 per cent of copper in this form may be toxic in its effects.

Experiments on the influence of the phosphate, carbonate, nitrate, sulphate, and chlorid of lead on wheat showed that "in no case was there any sign of injury, although lead had been used up to 0.1 per cent. The general result was to point, on the whole, to a stimulating effect rather than the reverse. This was especially marked with the phosphate series and the nitrate one. With the carbonate and sulphate the results were very similar to the untreated and with the chlorid the straw seemed to be somewhat reduced. . . . Therefore, lead can be used with impunity up to 0.1 per cent with any of the salts employed."

Experiments on the effects of adding lime to a soil rich in magnesia showed "that addition of lime to a soil rich in magnesia is beneficial and can be applied without detriment even to an extent where the lime is double the amount of magnesia present in the soil."

Soil-acidity experiments on soil continuously cropped to barley led to the conclusion "that where soil acidity has gone to the extent that a crop can not be produced, lime as carbonate of lime may advantageously be added to an extent exceeding that required to neutralize the acidity present, but that where acidity may be indicated but a fair crop be still produced, there is no advantage from adding lime as carbonate of lime even to the neutralizing point. Lastly, when no acidity is shown, further liming is thrown away." In no case did the use of calcium carbonate produce the harmful effects produced by caustic lime.

Experiments with mustard, barley, peas, and tomatoes to determine the influence of inoculating soil with Bottomley's peat preparation led to the conclusion that "the peat preparation exercised a distinct influence upon the vegetation. The results with barley, peas, and mustard, coupled with those on the vegetative growth of the tomatoes, clearly show that there is something effected by the peat and that this is due not to the chemical composition alone."

The Illinois system of soil fertility from the standpoint of the practical farmer, BROTHER LEO (*Illinois Sta. Circ. 186* (*1916*), *pp. 3–8*).—This is an address before the Illinois Farmers' Institute at Decatur, February 22, 1916, in which a popular discussion of the well-known Illinois system of soil fertility is given together with an account of the successful use of this system on the farm of the University of Notre Dame.

The use of fertilizers in 1916, W. P. BROOKS (*Massachusetts Sta. Circ. 59* (*1915*), *pp. 8*).—This circular gives the substance of the points agreed upon at a conference of the directors of the New York, New Jersey, and New England stations, with the addition in a few cases of conclusions based chiefly upon results of experimental work at the Massachusetts Station.

Growing crops without potash in 1916, C. D. WOODS (*Maine Sta. Doc. 520* (*1915*), *pp. 15*).—This is an address delivered before the Maine Seed Improvement Association, December 8, 1915, which is based in part upon the conclusions reached at a meeting of the directors of the New England, New Jersey, and New York stations and in part on special studies made by the Maine Station.

The action of new nitrogenous fertilizers, GERLACH (*Mitt. Deut. Landw. Gesell., 31* (*1916*), *No. 7, pp. 90–93*).—Pot experiments with oats and white mustard on weak humus loamy sand and loamy sand, plat experiments with oats, rye, and wheat on loamy sand, and field experiments with beets, barley, and rye on loamy sand and light loamy sand soil are reported, the purpose of which was to determine the relative fertilizing action of sodium nitrate, lime nitrogen, urea, urea nitrate, ammonium sulphate, ammonium chlorid, ammonium bicarbonate, ammonium sodium sulphate, and an organic nitrogenous fertilizer.

It was found that under the favorable conditions existing in the pot experiments, lime nitrogen and urea showed a fertilizing action approximately equal to that of the ammonium and nitrate fertilizers. In the field experiments, and especially on light soils, the opposite was frequently the case. Urea usually gave better results than lime nitrogen. The lime nitrogen gave, in general, relatively unfavorable results and it is thought that field experiments of long duration with it and urea are necessary to determine the conditions for their best utilization. Urea nitrate, while not generally giving the same results as urea, is considered a valuable fertilizer. Ammonium chlorid and ammonium sodium sulphate gave as good results in pot cultures as ammonium sulphate, but the results of field experiments with these two fertilizers were unfavorable. Ammonium bicarbonate did not give as good results as the other fertilizer salts, especially on sand soils. The least favorable results were obtained from the organic fertilizer. No injurious action by any of the fertilizers was observed.

Phosphates and honesty, C. G. HOPKINS (*Illinois Sta. Circ. 186* (*1916*), *pp. 9–31*).—This is an address before the Illinois Farmers' Institute at Decatur, February 22, 1916, consisting of a summary of results of experiments at a number of the state agricultural experiment stations on the use of phosphatic fertilizers from which it is concluded "that where phosphorus is deficient in the soil it must be applied in order to increase and permanently maintain fertility or productive power. At moderate prices either bone meal, acid phosphate, basic slag phosphate, or fine-ground natural rock phosphate may be used with profit. When prices are sufficiently low, the more readily available phosphates are probably best, especially for garden crops or on soils which are deficient in decaying organic matter, or when the cost of raw phosphate is prohibitive; but even for garden crops, and also in beginning soil improvements for general farm crops even before adequate supplies of organic matter can be provided. liberal applications of raw phosphate may well be used when exhorbitant prices are charged for other phosphates."

Certain factors which influence the fertilizing action of the slightly soluble phosphates, H. G. Söderbaum (*K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 5, pp. 448–477, figs. 7; Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 112 (1915), pp. 35, figs. 7; abs. in Chem. Abs., 9 (1915), No. 23, p. 3319*).—Pot culture experiments with oats, barley, rye, and wheat on soils deficient in both nitrogen and phosphoric acid to determine the influence of the carbonate and sulphate of magnesium, sodium nitrate, ammonium sulphate, and organic nitrogen on the fertilizing action of superphosphate, Thomas slag, dicalcium phosphate, tricalcium phosphate, bone meal, Algerian phosphate, and apatite are reported.

Previous experiments on the influence of lime on the slightly soluble phosphates are reviewed, which showed that while the addition of lime to the readily soluble phosphates had no marked influence upon their fertilizing action, that of the less soluble phosphates was inhibited. With a low lime content in the soil either type of phosphate was used to advantage, but with a high lime content the insoluble phosphates gave no favorable results.

In the present experiments it was found that when using superphosphate a larger crop yield was obtained with ammonium sulphate than with sodium nitrate, but when using tricalcium phosphate the opposite was true. The results varied with the crops, wheat being more sensitive than the others. When using dicalcium phosphate little difference was observed in the action of the two nitrogen compounds. With the less soluble phosphates ammonium sulphate and organic nitrogen proved superior to sodium nitrate, except with barley, with which ammonium sulphate and organic nitrogen always gave a poorer crop than sodium nitrate, regardless of the type of phosphate used. When magnesium sulphate was used with the readily soluble phosphates, little influence was observed on crop growth, regardless of the form of nitrogen used, but when magnesium carbonate and ammonium sulphate were used with readily soluble phosphates a distinctly increased yield was obtained. With the less soluble phosphates, magnesium sulphate gave slight and conflicting results, and the results obtained with magnesium carbonate varied with the plant, the yield of rye and wheat being increased and that of barley and oats slightly decreased.

Displacement of the potash and phosphoric-acid contents of certain rocks by some fertilizers, G. André (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 3, pp. 133–136; abs. in Rev. Sci. [Paris], 54 (1916), I, No. 3, p. 94*).—Experiments conducted along lines similar to those with feldspar, previously noted (E. S. R., 30, p. 126), are reported in which glauconite containing 7.08 per cent potash was subjected to the action of calcium carbonate, sodium chlorid, sodium carbonate, ammonium sulphate, and calcium sulphate in the presence of water, using 1 gm. of the salts to 10 gm. of glauconite. It was found that the salts in the order mentioned dissolved 3.24, 5.67, 5.62, 7.17, 9.97, and 5.56 per cent of the total potash content of the glauconite. These results are said to be greater than those obtained with feldspar.

In further experiments with apatite, using ammonium carbonate, sodium nitrate, potassium nitrate, and potassium carbonate, it was found that ammonium carbonate and the nitrates failed to displace any appreciable amount of phosphoric acid. Potassium carbonate displaced about 0.35 per cent of the phosphoric-acid content of the apatite.

Feldspar as a possible source of American potash, A. S. Cushman and G. W. Coggeshall (*Trans. Amer. Inst. Chem. Engin., 7 (1914), pp. 184–202*).—In a second contribution to the subject (E. S. R., 27, p. 724), the authors report additional investigations which were conducted with the idea of separating and

concentrating the soluble potash salts made available by the process previously noted. The process developed has been previously described by Coggeshall (E. S. R., 34, p. 27).

The results of a comparison of the product with imported German muriates are taken to indicate that "without any attempt at fractional separation, muriate of potash may be made from American feldspars equal in character to the usual imported muriates, and that they are as well adapted to be used in commercial mixed fertilizers as those imported." After a further comparison and discussion of costs of plant and operation, it is stated that "if 80 per cent muriate of potash has been heretofore used at a cost in this country of $37.50 per ton, there is shown a saving by the above process of over $6 per ton, or 20 per cent profit on the manufacturing cost."

Potash from fir wood mill waste, H. F. ZOLLER (*Jour. Indus. and Engin. Chem., 8 (1916), No. 2, pp. 105–108*).—Analyses of Douglas fir and cedar ashes are reported, the results of which, together with other general considerations, are taken to indicate "that it is possible to obtain potash, calculated as K_2O, from Douglas fir mill waste incinerators in the amounts of from 10 to 20 lbs. per ton of 'ash' employed. Furthermore, that this potash may be obtained, along with other extractable matter, by merely leaching the ash in suitable vats with hot water for a 24-hour period and in all probability a 12-hour period would be as efficient."

Potash from kelp: A record of handling kelp in commercial large-scale operation, I. F. LAUCKS (*Metallurg. and Chem. Engin., 14 (1916), No. 6, pp. 304–308, figs. 6*).—This is a record of a trial of large scale kelp handling operations, confined entirely to the species *Nereocystis luetkeana* of Puget Sound, including methods and cost of harvesting, transporting, and drying.

It is stated that this type of kelp contains an average of between 92 and 93 per cent water. "The cheapest and most satisfactory type of conveyor is the chain conveyor with wooden flights and either double or single chain. . . . The direct-heat rotary drier appears to be the most satisfactory type."

The composition and use of certain seaweeds, J. HENDRICK (*Jour. Bd. Agr. [London], 22 (1916), No. 11, pp. 1095–1107*).—A summary of analyses of a large number of samples of the common seaweeds and their ash collected from different points on the coast of Scotland is given. The following table shows the percentages of ash and of potash in the ash of the different seaweeds:

Ash and potash of seaweed.

Kind of seaweed.	Ash in weed as received.			Potash in ash.		
	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.
Laminaria digitata:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Stems	8.19	4.78	6.32	35.62	20.10	28.71
Fronds	10.46	3.75	5.66	26.35	16.80	20.99
L. stenophylla:						
Stems	6.15	5.56	5.78	39.21	27.07	33.60
Fronds	5.22	4.31	4.66	22.03	17.47	20.21
Fucus vesiculosus	9.06	4.66	6.53	20.82	12.35	15.29
F. nodosus	8.02	5.52	6.35	14.88	9.47	12.22
F. serratus	6.64	4.88	5.49	20.76	16.71	18.60

The fertilizing action of sodium chlorid, B. SCHULZE (*Landw. Vers. Stat., 86 (1915), No. 5–6. pp. 323–330; abs. in Chem. Zentbl., 1915, II, No. 5, p. 239; Ztschr. Angew. Chem., 28 (1915), No. 65, Referatenteil, p. 421; Jour. Chem. Soc. [London], 108 (1915), No. 634, I, p. 764*).—Pot experiments with mustard on a

soil poor in potash and on a mixture of loam soil and sand to determine the extent of the action of common salt in setting free the potash from an artificial potassium zeolite are reported. The results are taken to indicate that common salt solution does not have a solvent effect on potassium zeolites, and that if an increase in crop is obtained by fertilizing with common salt it can not be attributed to the indirect effect of the salt in setting free the potash of potassium zeolites in the soil. It is further concluded that sodium may act directly as a nutritive element for some plants.

Bat fertilizers, C. N. AGETON (*Estac. Expt. Agron. [Cuba], Informe An., 3 (1909–1914), pp. 92–97*).—Analyses of 37 samples of bat guano from Cuba are reported and discussed.

Notes on the chemical composition of Karroo ash, C. F. JURITZ (*So. African Jour. Sci., 12 (1915), No. 4, pp. 133–142*).—A number of miscellaneous analyses of kraal manure and the burned manure ash from stock-raising districts of South Africa are reported. A summary of analyses of 29 samples of the ash showed average contents of potash 9.85, lime 21.81, and phosphoric acid 2.86 per cent.

Fertilizer analyses, A. J. PATTEN, O. B. WINTER, O. F. JENSEN, and E. F. BERGER (*Michigan Sta. Bul. 275 (1915), pp. 3–25*).—This bulletin contains the results of actual and guarantied analyses of 358 samples of fertilizers and fertilizing materials representing 300 brands offered for sale in Michigan during 1915. Of these 21 were below guaranty in nitrogen, 19 in available phosphoric acid, 5 in total phosphoric acid, and 33 in potash.

Tabulated analyses of commercial fertilizers and fertilizer materials, J. W. SAMPLE (*Tenn. Dept. Agr. Fert. Bul. 1915, pp. 61*).—This bulletin contains the results of actual and guarantied analyses of 376 samples of fertilizers and fertilizing materials collected for inspection in Tennessee during 1915, together with general information for farmers on the use of fertilizers and the text of the state fertilizer inspection law.

Commercial fertilizers, inspection 1915, B. H. HITE and F. B. KUNST (*West Virginia Sta. Insp. Bul. 4 (1916), pp. 69*).—This bulletin contains the results of actual and guarantied analyses of 332 samples of fertilizers and fertilizing materials collected for inspection in West Virginia during 1915, together with a discussion of the fertilizer situation, inspection work, etc.

AGRICULTURAL BOTANY.

Agricultural bacteriology, H. L. RUSSELL and E. G. HASTINGS (*Madison, Wis.: H. L. Russell, 1915, pp. VI+304, figs. 48*).—The present edition (E. S. R., 22, p. 723) treats of the properties of micro-organisms, soil bacteriology, the relation of micro-organisms to foods, and transmissible diseases. One chapter deals with bacterial diseases of plants.

Determining types of genera, O. F. COOK (*Jour. Wash. Acad. Sci., 6 (1916), No. 6, pp. 137–140*).—This is a discussion of the need for a stable taxonomy in both branches of biological science and the difficulties to be overcome in working out a practicable system.

Physiological temperature indices for the study of plant growth in relation to climatic conditions, B. E. LIVINGSTON (*Physiol. Researches, 1 (1916), No. 8, pp. 399–420, figs. 4; abs. in Science, n. ser., 43 (1916), No. 1106, p. 362*).—This publication deals with the derivation and use of a series of physiological indices of temperature efficiency for plant growth, these indices being derived from data obtained by Lehenbauer in a study of the relation of temperature to the elongation rate in seedling maize shoots (E. S. R., 32, p. 334). The system

is said to differ from others in that it is based on actual physiological experimentation, it takes account of the general principle of temperature minima, optima, and maxima, and it shows a much greater rate of increase for the index value with rising temperature between 35.6 and 89.6° F. (2 to 32° C.) than does either of the other systems to which, on whole, it is considered preferable.

By the use of these new indices, physiological summation indices of temperature efficiency for plant growth have been obtained for many stations in the United States, and these have been charted to give a new temperature zone map of the country. It is thought that the physiological system of indices gives the nearest approach yet made to a true expression of the relation of temperature to plant growth.

Acacia seedlings, R. H. CAMBAGE (*Jour. and Proc. Roy. Soc. N. S. Wales, 49 (1915), pt. 1, pp. 81–121, pls. 5, figs. 5*).—The author gives details obtained by him in the study of species of Acacia as met with in Australia, where members of this genus show various forms and degrees of variation of the several parts, presumably under the influence of the peculiar conditions there prevailing.

Multiple leaves in clover, J. PERRIRAZ (*Bul. Soc. Vaud. Sci. Nat., 5. ser., 50 (1914). No. 182, pp. 15–22, fig. 1*).—The author concludes a discussion of his observations by stating that the appearance of supplementary leaflets in the different species of clover is due to heredity or to nutritive factors. These may be distinguished, as the latter appear on the same plan as the normal growth while the former appear on a different plan.

Variations in flowers of Iris, R. PIROTTA (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 9, pp. 897, 898*).—Discussing the appearance in Iris flowers of flecks, spots, or lines, which in some cases were even showy, varying in form, size, number, and position, or sometimes lacking in successive seasons, the author mentions his more recent observations of other variations, which are as yet incomplete.

On the inheritance of the flowering time in peas and rice, Y. HOSHINO (*Jour. Col. Agr. Tohoku Imp. Univ., 6 (1915), No. 9, pp. 229–288, pls. 5*).—Since 1907 the author has carried on genetical studies with rice and peas, his work bearing upon the theory of a multiple factor.

It is claimed that his experimentation has demonstrated the fixity of the character of flowering time in the original varieties of peas and the presence of two pure lines in the population of one variety. Flowering time in the F_1 generation inclines toward the late parent in peas, toward the early one in rice. The variation range of F_2 families covers the combined range of both parent varieties, but their variation type is not the ordinary one. The inheritance of flowering time follows the Mendelian law in the F_3 and F_4 generations. As an explanation of the inheritance of flowering time in peas, the author suggests the presence of two Mendelian factors which differ in their effects, and gametic contamination caused by hybridization whose nature is not yet explainable. From a study of the variation types in peas, it is thought that the hereditary difference of the two pure lines is qualitative and not quantitative. A correlation is noted between flowering time and flower color in peas, which is thought to be explainable by assuming gametic coupling between the color factor and one of the two factors for flowering time.

A bud variation of the scarlet runner, J. REINKE (*Ber. Deut. Bot. Gesell., 33 (1915), No. 7, pp. 324–348*).—An account with discussion is given of the appearance in 1913 of a strain of *Phaseolus multiflorus*, some of the upper inflorescences of which bore white corollas, also further observations upon phases of development and heredity in the progeny.

Amphiclinous hybrids, H. de Vries (*Ber. Deut. Bot. Gesell., 33 (1915), No. 8, pp. 461–468*).—The author has found that the crossing of *Œnothera lamarckiana* with *Œ. lamarckiana nanella* gives, according to cultural conditions, from 0 to 90 per cent of dwarfs in the progeny. The percentage is usually below 50 per cent in the progeny of the first year, but above that figure in that of the second. These figures may be raised by early planting or abundant water supply during the period of root formation. The percentage of dwarfs in the progeny is thus not constant, depending greatly upon cultural conditions.

Recent mutations of Solanum commersonii, Labergerie (*Rev. Vit., 43 (1915), No. 1117, pp. 406, 407*).—An account is given of the sudden appearance in 1914 of two mutants, which are described, in the progeny of two plants of *S. commersonii* grown for several years in contact with a domestic variety of potato. The phenomena noted are compared with those reported by Planchon (E. S. R., 28, p. 130) and Heckel (E. S. R., 33, p. 222). It is suggested that solar illumination may be a factor in such cases.

A case of leaf etiolation due to cold, G. Gassner (*Ber. Deut. Bot. Gesell., 33 (1915), No. 8, pp. 478–486, pl. 1*).—Studies previously reported by the author, partly in connection with Appel (E. S. R., 19, p. 345), have been followed up with tests of the aftereffects of low temperatures on germinating oats. Plants germinated at from 1 to 2° C., as compared with those sprouted at 5 to 6° or 20°, remained pale and backward in growth under favorable conditions of heat and light.

Experimental production of tuberous growth at the expense of the root in potato, M. Molliard (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 18, pp. 531, 532*).—The author produced in potato seedlings grown in tightly closed tubes tuberous development containing starch on the lower part of the stem, apparently at the expense of other portions of the plant. These conditions showed marked contrast with those in plants similarly kept, except that air was freely admitted.

The question of a physiological unity constituted by a leaf with its internode, J. Kuijper (Kuyper) (*Arch. Suikerindus. Nederland. Indië, 23 (1915), No. 34, pp. 1285–1293, fig. 1*).—The question regarding a possible physiological unity constituted by the leaf blade, the leaf sheath, and the internode having arisen in the course of previous work (E. S. R., 34, p. 627), the author has investigated different varieties of sugar cane. From this work he has concluded that the view of a purely local physiological influence in case of a given leaf is not supported by the evidence obtained.

Contributions to the physiology of stomata in Saccharum officinarum, J. Kuijper (Kuyper) (*Arch. Suikerindus. Nederland. Indië, 23 (1915), No. 44, pp. 1673–1700, pl. 1*).—Studies previously noted regarding stomatal structure in sugar cane (E. S. R., 34, p. 628) have been followed up with investigations of the influence on stomatal behavior of light, temperature, and humidity.

It is stated that while direct sunshine is very effective in causing the stomata to open, darkness causes them to close, although in prolonged darkness the stomata sometimes open to a very small but constant degree. In moderate illumination from a clouded sky, the stomata open slowly and slightly as compared with the behavior in strong sunshine, sunny mornings appearing to be valuable from the standpoint of cane culture. When temperatures of from 43 to 45° C. (109.4 to 113° F.) were produced by the absorption of sunshine by the dark cloth covers the stomata were opened by the heat, but when a shelter was provided the stomata closed normally as in darkness. So far as it was possible to ascertain the influence of air humidity free from complication by other factors, a high humidity of the air appears to increase stomatal opening.

The morning rate of penetration is greater than the afternoon rate in every variety, but the hour of closing and the difference between maximum and minimum opening differ with the variety. The author thinks that early closing may be a profitable feature for the plant on account of a more economical water balance.

It is thought that, while many facts referred to periodicity may be explained by the influence of light, temperature, and water content, there are still some indications that after a prolonged period of darkness, the stomata tend to open between 8 and 10 a. m., suggesting a tendency to periodicity.

Observations on transpiration in sugar cane, J. KUIJPER (KUYPER) (*Arch. Suikerindus. Nederland. Indië, 23 (1915), No. 45, pp. 1715–1733, pl. 1, fig. 1*).—The work above reported was followed up with experiments on transpiration in connection with the movements of the stomata and accompanying water loss in sugar cane. Fresh stalks from six to nine months old were cut in the early morning and placed in large bottles of water the surface of which was protected from evaporation by a layer of oil.

Abundant watering of the plants approximately doubled the amount of water ordinarily transpired. The daily course of transpiration in different varieties permits their arrangement into three groups, two of these attaining their maxima respectively in early morning and at 11 o'clock, while those of the third group show very small differences during the whole day. These differences in the utilization of available water are supposed to correspond to differences in production and in resistance to drought.

The daily loss of weight in one variety may double that in another. No connection was established between transpiration rate and stomatal count of leaf area. The maximum transpiration rate may be reached after the stomata have begun to close, the rate of transpiration being in a measure independent of stomatal behavior. Decrease or deprivation of light decreases transpiration. The varietal differences in transpiration rate are thought to be important as giving a new basis for the selection of canes for certain conditions of soil and climate.

Sap ascent, A. MAILLEFER (*Bul. Soc. Vaud. Sci. Nat., 5. ser., 50 (1914), No. 182, pp. 23–30*).—It is thought that the amount of energy due to transpiration of water evaporated, 15.1 kilogrammeters per kilogram, is insufficient to account for the observed facts of sap ascent, and that the living cells of the wood must also play a part.

A new theory of gum flow, P. SORAUER (*Ztschr. Pflanzenkrank., 25 (1915), Nos. 2, pp. 71–84; 3, pp. 134–154, figs. 6*).—As a result of later studies (E. S. R., 27, p. 851) on the characters and behavior of cells and tissues in plants showing gum flow, the author states that cultivated cherry trees belong to one of those families which show considerable tendency to liquidation of certain portions of their cell membranes due to reactions in various stored substances. This tendency may often be noted in very young branch tips which may show cell deterioration or gummosis. The conditions for gummosis here existing do not necessarily result in its appearance, often having only symptomatic significance and showing on examination merely more or less predisposition thereto.

It appears that gummosis is primarily a condition of local plethora or a storing of material which, on account of its richness in hydrolyzing enzyms, can not develop into normal cell tissue. This condition manifests itself through the coloration of certain cells and may be related in its development to weather and nutritive conditions.

The artificial absorption of liquids by aerial parts of plants, C. ACQUA (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 23 (1914), II, No. 3, pp. 78–84*).—Experiments are described leading to the conclusion that

plants can easily take up substances in solution, either by means of their leaf surfaces or through cut ends of branches, the latter method entailing comparatively slight injury. While some plants are said to resist for a longer time seasonal or abnormal tendencies under the influence of absorbed solutes, it is thought that no very important alterations of the general condition of the plants can be produced in this way at the present time. It is believed, however, that these methods may be employed in the study of some important agricultural problems.

Albuminous bodies in cells as ergastic substances, A. Meyer (*Ber. Deut. Bot. Gesell., 33 (1915), No. 7, pp. 373–379*).—This is a preliminary discussion of the author's conception of dissolved or ultramicroscopic substances or bodies as a reserve at the disposal of the working portions of the cells.

The physiological theory of chlorophyll, E. G. Pringsheim (*Ber. Deut. Bot. Gesell., 33 (1915), No. 7, pp. 379–385*).—This is largely a discussion of the contributions by Iwanowski (E. S. R., 33, p. 824) on a physiological theory of chlorophyll.

Artificial hastening by pressure of water absorption by seeds, H. de Vries (*Biol. Centbl., 35 (1915), No. 4, pp. 161–176*).—On account of the slow and partial germination of the seeds in testing for mutation, involving the danger of loss of possible forms, the author attempted to overcome the difficulty by subjecting the seeds to pressures of from 6 to 8 atmospheres for 2 or 3 days.

It was found that the rate of germination was largely increased, approaching, or in some cases reaching, 100 per cent. It is thought that the effect of pressure is to force the water into the interstices from which it is ordinarily excluded by air spaces or bubbles.

The action of hydrogen ions and some anions on the germinative period of Avena sativa, F. Plate (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 23 (1914), II, No. 5, pp. 166–171*).—Reporting studies related to those previously noted (E. S. R., 33, p. 727), and testing the influences of common acids on the growth of *A. sativa*, the author states that both cations and anions exert influences which are chemically and biologically distinct. The hydrogen ion is localized and exerts its influence mainly in the roots, and the anion is localized and exerts its influence in the region of the growing points.

Studies on the influence of the chlorids on the germinative period of Avena sativa, F. Plate (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 23 (1914), II, No. 6, pp. 234–238*).—In continuance of the studies reported above, but employing chlorids in solutions of different strengths, the author details the effects thereby produced on growth. An arrangement is made of alkaline nitrates and chlorids in two series according to their observed effects on the total weight of the plant, growth of root, growth of shoot, correlation of development, and atomic weights of the positive elements employed.

It is stated that the kind of anion present has a certain influence upon the action of the cation employed when the action of the latter is not toxic to the plant. If the cation is decidedly toxic, this toxicity is maintained whatever anion may be employed.

Hydrocyanic acid formation in the germination of seeds, III, IV, G. Ravenna (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 23 (1914), II, No. 6, pp. 222–226; 7, pp. 302–306*).—In pursuance of reports on studies carried out in connection with others (E. S. R., 24, p. 534; 27, p. 132), the author gives an account of the methods employed and the results obtained in a study of hydrocyanic acid in germinating seeds of *Phaseolus lunatus*. An augmentation of that component was noted in the early period of germination, but this was followed by a diminution.

Experiments on the physiology of indigo-yielding glucosids, F. R. PARNELL (*Mem. Dept. Agr. India, Bot. Ser., 7 (1915), No. 5, pp. 195–212*).—Giving details of a study on parts of several plants, the author states that an indigo-yielding glucosid is present in the roots and seeds of *Wrightia tinctoria* and of *W. tomentosa*, but not in the leaves of the latter. The glucosid and its enzym in *W. tinctoria* are distinct from those of *Indigofera arrecta* and *I. sumatrana*. The glucosid content in *W. tinctoria* seed germinated and grown without nitrogen supply increases to about 300 per cent in about 40 days, but it decreases considerably as nitrogen starvation progresses. *W. tomentosa* seedlings show no appreciable increase of glucosid under like conditions. In cuttings of *Polygonum tinctorium* and *Strobilanthes flaccidifolius* grown without nitrogen part of the glucosid disappears, presumably being used up as a nitrogenous reserve. In *W. tinctoria* and *I. arrecta* the maximum percentage content occurs very early in the leaf development, the actual amount in any leaf increasing during growth to maturity and then remaining constant until after the leaves fall.

Indican is produced in the dark by etiolated shoots of *I. arrecta*. There is no variation in indican content between night and day in *I. arrecta* and *I. sumatrana*, and no marked change is observable after keeping *I. sumatrana* in the dark for 36 hours.

No definite function is assigned to indigo-yielding glucosids in general or to those of any particular species.

Cytological observations on the mode of formation of anthocyanin pigments in flowers, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 17, pp. 494–497*).—Referring to the recent work of Moreau (E. S. R., 33, p. 523) as confirmatory of his own views previously noted (E. S. R., 30, p. 729), the author gives a résumé of the results of his own studies during 1914 and 1915.

It is stated that in the flower of canna, the formation of anthocyanin involves a process identical with that observed in leaflets of rose. Observations on *Pelargonium zonale* and *Iris germanica* are also described. In the latter the formation of anthocyanin presents two phases which are discussed. These studies are held to confirm the conclusion previously reached by the author and by Moreau that anthocyanin is formed in flowers exactly as it is in leaves.

The coloring matters of chromatophores, H. KYLIN (*Naturw. Wchnschr., 31 (1916), No. 7, pp. 97–103, figs. 8*).—Noting results of studies on the color constituents in higher plants and algæ, the author discusses their properties and their probable significance in connection with the activities of the plants.

Alkaloid formation in plants.—I, Studies on protein and nicotin content during growth, H. B. RASMUSSEN (*Biochem. Ztschr., 69 (1915), No. 5–6, pp. 461–466*).—These studies, carried out with *Nicotiana rustica* and with Hungarian and Virginia varieties of tobacco, show no clear and constant relation between the richness of the fertilizers used and the nicotin content of the resulting plants, but they do show an increase of nicotin with the age and growth of the plants. The total nitrogen varied during growth according to the variety of the plant and the situation of the leaves tested. In the less strongly manured plants, the total protein nitrogen decreased with their age. In the more heavily manured, the autumn content was greater than that of August.

The morning and evening content of mulberry leaves, L. PIGORINI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 23 (1914), II, No. 9, pp. 433–437*).—Analyses of mulberry leaves are said to have shown that in sunlight such leaves increase from morning to evening their content of organic

substances, including carbohydrates, fats, and both proteid and nonproteid nitrogenous materials, furnishing thus a greater amount of nutritive matter in the latter part of the day.

Plant enzyms.—IV, Invertase of potato leaves, G. Doby (*Biochem. Ztschr., 71 (1915), No. 6, pp. 495–500*).—Continuing previous work (E. S. R., 34, p. 428), the author has studied the activity of the enzyms obtained from comminuted potato leaves as found in their expressed juices.

The activity of the enzyms contained in the juices as obtained by hand pressure diminished sensibly after the material had been kept for 24 hours. Those obtained by pressures of 100 and 300 atmospheres showed successively lessened enzym activity. It is considered probable that the decreased activity is due partly to a diminution of the enzyms in the juices obtained at higher pressure, but also perhaps to a rapid breaking down of the enzyms themselves.

A note on the occurrence of urease in legume nodules and other plant parts, M. S. Benjamin (*Jour. and Proc. Roy. Soc. N. S. Wales, 49 (1915), pt. 1, pp. 78–80*).—The author states that, having detected the presence of an enzym capable of splitting urea in the nodules of *Trifolium agrarium, T. minus, Pisum arvense, Vicia dosciacarpus, V. sativa, Glycine clandestina, Acacia decurrens, A. falcata, A. juniperina, A. linearis, A. lunata, A. pumila, A. suaveolens, Aotus villosa, Daviesia genistifolia, Lathyrus latifolius,* and *Cytisus proliferus,* but not in those of *Medicago sativa, M. denticulata, M. maculata,* or *Trifolium repens,* he has extended his study to other parts of plants. A reaction for the presence of the enzym was given by seeds of *Cucumis melo, Cucurbita moschata,* and *Abrus precatorius.* Other plant parts giving a reaction for urease were the ovules and pollen of a Hippeastrum, the tubercles, rootlets, and bulbs of *Macrozamia spiralis,* and the dried, immature leaves of a Wistaria. The reaction proper to the enzym was obtained from a red and a green alga, and it was particularly pronounced and rapid in case of the lichens *Ramulina yemensis, Xanthoria parietina,* and *Usnea barbata.*

Although no conclusions are drawn as to the part played by this enzym in the economy of plants, the fact that it has been detected in parts in which symbiosis occurs and in other parts in which active metabolic changes are doubtless in progress, as in pollen, ovules, young leaves, etc., suggests some correlation between its presence and the processes of elaboration and interchange of nutritive material which must be constantly occurring in the living plant.

A new nitrite-forming organism, N. V. Joshi (*Mem. Dept. Agr. India, Bact. Ser., 1 (1915), No. 3, pp. 85–96, pls. 2, fig. 1*).—An account is given of the discovery and study of a nitrite-forming organism, with an outline of its reactions to temperature, chemical agents, and nutrient preparations.

The influence of ultraviolet rays on reproductive organs of plants, L. Montemartini (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 9 (1911), pp. 13–23*).—In these experiments, carried out with several plants named, the author was not able to discover any specific action of ultraviolet rays on the reproductive organs of the plants tested.

FIELD CROPS.

Experiments on the influence of selection, C. Fruwirth (*Ztschr. Pflanzenzücht., 3 (1915), Nos. 2, p. 173; 4, pp. 395–451, figs. 5*).—The experiments here described were conducted with white mustard (*Sinapis alba*), oats, and certain leguminous plants.

The results obtained with six Johannsen lines of white mustard, producing yellow and brown seeds and sometimes both kinds on the same plant, showed

that continuous selection of either the yellow or the brown seeded forms failed to establish pure transmission of the seed color. It was further found that self-pollination of mustard can take place and that self-pollination continued several generations does not reduce the yield of seed or give rise to weak plants. Crossing a pure yellow-seeded form with a brown-seeded plant of one of the lines studied indicated that xenia in the yellow-seeded mother plant may show itself in the form of a browning of the seed coat. Such a cross also showed a different behavior in the F_1 and a different segregation in later generations than the cross of pure yellow-seeded with pure brown-seeded mustard.

Experiments were conducted with oats to determine whether individual Johannsen lines may be permanently distinguishable from each other by means of the hairs and awns of the outer or lower grains in the spikelets, the color of the glumes of these grains, or the number of grains per spikelet, even when selection in opposition to the line characters is practiced. After the constancy of the line character had become apparent, a comparison of a number of morphologically uniform lines was made to establish whether the relative heritability of characters finds expression each year or only in the average of several years. Finally, studies were made to determine whether seasonal conditions had a definite influence on the characters under observation. The work was begun with four plants grown from grains taken in 1906 from seed of Sechsamt oats.

The observations made on a series of external characters indicated without exception that in a Johannsen line definitely directed selection, even if carried through a comparatively large number of generations, does not modify the line character. The different characters studied were the varying degree of development of the highly modifiable coloring of the seed coat, the interchange between two colors of the seed coat as exhibited in subvarieties of mustard, and the variable development of the very strongly modifiable external characters of hairiness, the presence of awns in the outer grains of oats, and the number of grains produced per spikelet in oats. A number of cases of spontaneous qualitative variation which appeared after a varying number of generations had been self-pollinated are reported.

From the results of the breeding investigations it was concluded that certain external characters, such as those mentioned above as having been the subject of these studies, can not be brought, even by means of continued self-pollination and selection, to a more definite, permanent, and stronger expression. It is stated that the Johannsen lines in question belong to form groups which either show the several characters with different degrees of modification or, as in the case of the mustard lines, represent subvarieties. The statement is made that seed production in the field is more difficult when the particular form group has such highly variable external characters as some of the Johannsen lines of legumes and oats here studied. It is believed that the value of continuing selection with self-pollinated plants was further brought out by the possibility of spontaneous qualitative variations as shown in these experiments, as well as by the fact that certain branches of a Johannsen line may exhibit a difference in growth for several years. Spontaneous quantitative variations were not observed in any of the lines under experiment.

[Work with field crops], A. Boss (*Minnesota Sta. Rpt. 1915, pp. 35, 36*).—The activities of the sections of farm crops and of plant breeding are briefly noted.

Experiments with different grades of seed oats are reported as showing that the heavier seed gave the larger increased return for the labor of preparation, and that for certain varieties of oats thick seeding seemed to be an advantage.

Minnesota No. 261, an early variety selected from the Kherson, outyielded the medium early varieties of oats in the season's trials. In seeding tests with wheat, 1.75 bu. of seed per acre yielded 2.2 bu. more than seeding 1.25 bu., the common rate of drilling.

The results of forage crop studies indicated that as good stands of alfalfa were secured where nurse crops were used as where the crop was sown alone. July seeding, when no nurse crop was used, resulted in the best stands and in the best yields the following year, as compared with seeding in August after potatoes or barley. Inoculation increased the yield and gave a product richer in protein. The soil transfer method of inoculating gave somewhat better results than the use of commercial cultures, and the application of lime gave a definite increase in yield.

Sudan grass gave an average yield of 3.36 tons per acre, and where cut for seed, 700 lbs. of seed were secured. The best yield of hay was obtained by drilling 24 lbs. of seed per acre on June 15 and the best yield of seed by sowing 40 lbs. of seed with a grain drill on May 15.

Experiments with sweet clover pointed out the value of inoculation and the use of lime. Inoculation by transfer of sweet clover soil and the addition of lime gave a much larger yield than inoculation with sweet clover soil without lime or inoculation with alfalfa soil with lime. Where no treatment was given the yield was comparatively small.

Data accumulated in the continued selection of wheat for 14 years, with the object of shortening the stem between the head and the upper leaf for the purpose of decreasing the amount of surface exposed to rust, are reported as showing no progressive effect. The results of corn-breeding work during the year indicated little correlation between earliness of germination and time of maturity and no appreciable correlation between the rapidity of germination of seed of the same ears tested under different temperatures.

[Work with field crops], W. G. Taggart, A. P. Kerr, J. B. Garrett, and F. C. Quereau (*Louisiana Stas. Rpt. 1915, pp. 8–11, 15–17, 27, 28, 29, 30–32*).—At the Sugar Experiment Station a complete fertilizer containing 90 lbs. of sulphate of potash per acre gave an increase over check plats fertilized with equal amounts of nitrogen and phosphoric acid, but without potash, of 3.03, 3.55, and 1.73 tons of sugar cane per acre. A comparative test of nitrogenous fertilizers showed that calcium cyanamid ranked close to nitrate of soda and sulphate of ammonia. Calcium nitrate did not prove so satisfactory on sugar cane as on corn. A mixture of 500 lbs. of cotton-seed meal and 250 lbs. of acid phosphate per acre gave an increase of 2.7 tons of sugar cane, and a mixture of 500 lbs. of cotton-seed meal and 500 lbs. of acid phosphate an increase of 8.9 tons, as compared with no fertilizer treatment. A similar experiment in which tankage was used as the source of nitrogen gave an increase of 1.4 tons in the first place and 8.4 tons in the second. These results represent the average of four years. The use of 1.5 in. of water applied in irrigating sugar cane on April 28, May 17, and May 26, produced an increase of 7.6 tons of cane over an unirrigated check plat.

The propagation of new varieties of sugar cane showed that seedling L 511 made a good growth and contained 14.9 per cent of sucrose in the juice, or from 4.5 to 5 per cent more than the juice of cane grown generally. The next seedling in order of value was L 231, and, in addition to this, there were six others giving promising results.

The development of a white flint corn similar to Yellow Creole, which was found in variety tests to be the most suitable to local conditions as a general field crop, is reported. Corn fertilized before planting yielded 49.85 bu., while

corn receiving the fertilizer application after planting yielded 51.45 bu. per acre. Velvet beans proved a little better than cowpeas and soy beans for green manures. The results of experiments with corn indicated that bagasse had no value as a fertilizer. Other fertilizer experiments with corn indicated clearly the responsive power of stiff soils to pea-vine fallow and the use of nitrogenous fertilizers. Alfalfa produced 8.6 tons of hay per acre. Kudzu yielded a large quantity of forage and gave evidence of its value for smothering out Johnson grass.

A brief summary of the work at the State Station points out that a mixture of corn and soy beans, among the different crops tested, gave the best silage. The results of culture tests indicated that there was practically no difference in yield from the application of all of the fertilizer before planting, all during cultivation, or half before planting and half during the cultivation. Removing suckers from corn slightly increased the yield but not sufficiently to compensate for the labor. A plat where cowpeas were planted with corn when laid by, followed by a crop of clover in the fall with a light application of stable manure every three years, produced about five times as much corn as a plat receiving the same cultivation without the manurial treatment. Green manuring with red clover seemed to give as large a yield of corn as green manuring and an application of phosphate and lime in addition. Of 20 varieties of corn tested, Calhoun Red Cob and Yellow Creole were among those giving the best results in yield and in keeping qualities.

Among the forage crops tested, Sudan grass proved promising. It was found best to sow this grass at the rate of 20 lbs. per acre about April 1 in the locality of the station. The growth of ramie is reported as very successful.

At the North Louisiana Station rock phosphate and velvet beans have proved slightly inferior to acid phosphate in the production of both corn and cotton. The use of 315 lbs. of equal parts of cotton-seed meal and acid phosphate as a fertilizer for Sudan grass trebled the yield as compared with the yield of plats receiving no fertilizer. In a test of 18 varieties of cowpeas, Whippoorwill, Groit, New Era, and Brabham, proved superior. The yields of 14 varieties of soy beans varied from a little over 3 to 20.5 bu. per acre, Hollybrook being the leading variety. Of 13 crops, the rank-growing sorghums, particularly Honey sorghum, produced the heaviest tonnage of silage and soiling material. The maximum yield secured was a little over 34 tons per acre on good, red, sandy loam soil fertilized with 200 lbs. of cotton-seed meal and acid phosphate per acre.

The highest yielding varieties of sweet potatoes under test were Doody Yam, Jersey Yellow, and Southern Queen. Twelve fertilizer experiments with sweet potatoes did not give results with a degree of uniformity to warrant conclusions. It is reported that in a sweet potato storage house sweet potatoes were kept in good condition with very small loss.

In 42 tests in thinning cotton, uniformly better results have been secured by following the usual practices.

Plats under a 2, 3, and 4 year rotation experiment at the Rice Station gave an average yield of 17.6 barrels of rice per acre, while the check plats continuously in rice yielded 2.18 barrels per acre of pure red rice. Corn and oats were included in the rotation, and it is believed that rotations including upland crops should be of long duration and that under such a system several profitable crops of rice may be grown in succession.

The use of 200 lbs. acid phosphate per acre has produced the most profitable rice crops for five years in succession. Potash salts have not shown any appreciable increase in yield. Readily available forms of nitrogen were inferior

to organic forms for Honduras rice, but for late maturing varieties the differences were not great.

The Mungo bean appeared to make a heavier growth of vine than any other leguminous crop grown at the station. Garlic also seemed to do well on rice soils.

Suggestions for the use of fertilizers for tobacco and onions for 1916, H. D. HASKINS (*Massachusetts Sta. Circ. 60 (1916), pp. 4*).—A brief popular discussion of the use of fertilizers for tobacco and onions, suggesting for each crop two fertilizer formulas and noting the value of the use of lime.

Corn in Montana, A. ATKINSON and M. L. WILSON (*Montana Sta. Bul. 107 (1915), pp. 11–128, figs. 34*).—This bulletin discusses the economic importance of corn for Montana, reviews its history from its earliest culture by the Indians down to the present day, presents notes on the classification and varietal history of corn, describes a list of varieties adapted to certain regions of the State, and points out the influence of the prevailing climatic conditions on the production of the crop.

The results of experiments conducted in 1913 and 1914 at Wibaux, where the conditions of eastern Montana are fairly well represented, are reported in tables and discussed. Seven varieties of flint were found to have an average total leaf area per plant of 1,868.6 sq. in., 2 varieties of late flint of 2,124.4, 3 varieties of semident of 1,211, 6 varieties of early dent of 1,119.4, and 2 varieties of late dent 2,101.6 and 4,678.2 sq. in., respectively. The average length of stalk was 47.6 in. in the early flint, 70.1 in. in the semident, and 62.6 in. in the early dent varieties. No great variation was observed in the lengths of the first two or three internodes of any of the groups. Of the stalks studied the early flint varieties had from 6 to 9 internodes, the semident 8 to 11, and the early dent 9 to 10. In the early flint group the internodes were also much shorter than in the other groups. The early flint, early dent, and semident groups had about the same shelling percentage, which varied from 70 to 80 per cent. The proportions of coarse and fine stalk, shelled corn, and cob were determined and are reported in a table. The results of variety tests at Wibaux and at the Huntley substation are also tabulated.

Corn: Varieties, ear-row, and limiting factor tests, W. L. HUTCHINSON (*South Carolina Sta. Bul. 186 (1916), pp. 14*).—The results of variety and ear-to-row tests conducted at the station and the Pee Dee substation are tabulated. Data secured in fertilizer and culture tests made at the Pee Dee substation in 1914 and 1915 are also reported.

In 1913 the yields of 27 varieties at the station ranged from 28.3 to 49 bu. per acre, Surecropper being the leading variety, and in 1915 the yields of 9 varieties ranged from 24.5 to 37.5 bu., Coker Williamson being the leading sort. At the Pee Dee substation No. 181, among 20 varieties, stood first in yield in 1914 with 52.7 bu. per acre, and Chappell Garric, among 17 varieties in 1915, with 52.1 bu.

Ear-to-row tests at the station in 1913 indicated differences in yielding capacity ranging from 27.7 to 77.7 bu. per acre, and in 1915 from 5.2 to 59.7 bu. At the Pee Dee substation in a similar test in 1914, the lowest producing ear yielded at the rate of 24.3 and the highest at the rate of 50.3 bu. per acre.

The results secured in the fertilizer tests led to the conclusion that nitrogen is the element most needed under the conditions of the test. The culture tests indicated that the method of planting corn in the water furrow between beds and applying all fertilizers to the growing crop may have some merit. A plat treated in this way yielded at the rate of 48 bu. per acre, or more than any one of four other methods of culture under experiment.

Field corn in western Washington, E. B. STOOKEY (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 2, pp. 7–9*).—The possibility of growing corn in western Washington is discussed and some of the experimental work with corn by the substation is briefly noted. Conclusions based on general observations, as well as the results of experiments, are presented, and Minnesota No. 13, Rutherford Dent, Pearsall Dent, Northwestern Smoky Dent, Windus White Dent, and King Phillip are described with reference to their adaptability to the conditions and needs of the region.

Wilt-resistant varieties of cotton, E. F. CAUTHEN (*Alabama Col. Sta. Bul. 189 (1916), pp. 67–88, pl. 1, fig. 1*).—Tests made of wilt-resistant varieties of cotton in cooperation with farmers having suitable lands are reported, and notes are given on the nature of cotton wilt and on methods of controlling the disease. The wilt-resistant varieties, Dillon, Modella, Cook, Wood, Covington-Toole, Wilt-Resistant, Tri-Cook, Cook 307–6, Dixie, and Dix-Afifi, used in the experiment, are briefly described.

A comparison of the different varieties tested, based on the value of lint and seed per acre as indicated by the average results of 15 experiments, showed the following total values per acre: Cook, nonresistant strain, $26.78; Modella, $28.96; Wood, $33.09; Dixie, $33.22; Cook 307–6, $34.17; Covington-Toole, $34.42; and Tri-Cook, $40.53 per acre. The range of gains from resistant varieties extended from 8.1 per cent with Wood to 51.3 per cent with Tri-Cook. The average percentage of loss of plants from wilt in these tests was as follows: Cook, nonresistant strain, 40.3; Wood, 15.1; Modella, 14.7; Covington-Toole, 10.5; Cook 307–6, 9.3; Dixie, 8.5; Tri-Cook, 7.3; and Dillon, 5.4 per cent. Dix-Afifi lost no plants in the two experiments in which it was planted.

It is pointed out that these wilt-resistant varieties differ slightly in their relative earliness and that they are somewhat later in the time of opening than such standard varieties as Cleveland, Cook, and Triumph. Among the resistant varieties tested those ranking highest in total money value of seed and lint per acre were the earliest and turned out about 40 per cent of lint.

Methods and results of breeding flax, L. ALTHAUZEN (ALTHAUSEN) (*Zhur. Opytn. Agron. (Russ. Jour. Expt. Landw.), 15 (1914), No. 1, pp. 12–53, figs. 12*).—This article describes the methods of flax breeding employed by the agricultural chemical laboratory at St. Petersburg, together with the principles on which they are based. The work is planned to bring practical results in a short time and at a low expenditure of cost and effort. Some of the more general results are briefly noted.

It is pointed out that from a single selection made in 1909 there were obtained from the same variety seven different forms, among them one presenting with other characters an average length of stem of 80.6 cm. (31.4 in.) up to the point of branching and another with only 47.9 cm. as the corresponding figure. Selections made in 1911 of 24 commonly grown varieties of flax and propagated for two generations showed that these varieties represented a mixture of forms. The isolation of forms not only exhibited marked differences in height of plant, length of stem, and similar readily recognizable characters, but also variations in the color and size of the blossoms and other minor or less apparent qualities. One of the forms isolated had an average blossom diameter of 1.95 cm. as compared with 1.79 cm. and 1.67 cm. for a common variety grown as a check and a small blossomed form, respectively.

Natal grass, a southern perennial hay crop, S. M. TRACY (*U. S. Dept. Agr., Farmers' Bul. 726 (1916), pp. 16, figs. 4*).—Historical, descriptive, and cultural notes are given on Natal grass, and its value and uses are set forth. An analysis of Natal grass hay is included.

Field peas, N. S. Robb (*Idaho Sta. Circ. 2* (*1916*), *pp. 8, fig. 1*).—A brief popular account discussing the adaptation of field peas to climate and soil, the principal varieties, and the culture and uses of the crop.

Effect of climatic factors on the hydrocyanic-acid content of sorghum, J. J. Willaman and R. M. West (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 7, pp. 261–272, figs. 4*).—The experiments here described were in continuation of work previously noted (E. S. R., 33, p. 234), and were conducted by the Minnesota Experiment Station in 1915 to study the effect of climatic conditions on the amount of glucosid in the sorghum plant. For this purpose two varieties of sorghum, Southern Cane and Early Amber, were grown on plats in Minnesota, Utah, Kansas, and South Dakota, under widely different climatic and cultural conditions. The results are presented graphically and in their discussion the factors which might have any bearing on the cause of the variations in cyanid content or throw any light on the function of the glucosid dhurrin in sorghum are specially considered.

The amount of dhurrin in each plant was found to vary considerably. An unhealthy condition of plants, from whatever cause, was usually associated with a higher hydrocyanic-acid content than was found in healthy plants. It is thought possible that under such conditions the plant produces more glucosid for the sake of the stimulating hormones in it. The apparent effect of humidity and temperature on the amount of cyanid in sorghum is considered as probably due to the indirect effect on the rate of growth. Adequate water supply was usually accompanied by a low and inadequate by a high cyanic acid content. It is believed that this is probably due to the need of glucosid stimulation when the water supply becomes low. The character of the growth of the plant is reported as affecting the distribution of dhurrin between leaves and stalks. There was found a proportionately smaller amount in the thick heavy stalks than in the slender ones. It is stated that there is no consistent daily variation in the amount of dhurrin, and that this argues against the functioning of this glucosid as a food storage. The Southern Cane in every plat but one had a higher content of hydrocyanic acid than the Early Amber, and it is concluded that varietal difference is probably of more weight in determining the amount of hydrocyanic acid in sorghum than are the conditions of growth.

Nitrogen content of the wheat of the Transvolga region, N. Tulaikov (Tulajkow) (*Zhur. Opytn. Agron.* (*Russ. Jour. Expt. Landw.*), *15* (*1914*), *No. 1, pp. 1–11*).—Results of analyses made during the four years beginning with 1910 by the experiment station at Besentschuk showed that the nitrogen content of hard and soft wheats from this region was about the same, and that the average nitrogen content of the hard and soft wheats grown in 1911 in the various districts of the government of Ssamara was the same. The grain of different botanical subvarieties of spring wheat grown under the same conditions of soil and climate showed no differences in the content of total nitrogen. It is stated that variations in the nitrogen content of wheat of the harvest of a particular year and produced under identical climatic conditions must be attributed to differences in the chemical composition and osmotic pressure of the soil solution, as botanical differences have no influence in this connection.

Further observations on combating weeds with kainit, T. Remy and J. Vasters (*Landw. Jahrb., 48* (*1915*), *No. 1, pp. 137–169, pls. 4*).—The effect of applying kainit, calcium cyanamid, and iron sulphate in controlling ragwort, cornflower, wild poppy, wild radish, coltsfoot, wild mustard, Canada thistle, sour thistle, and colchicum was observed in field and pot experiments.

The results confirmed the conclusions drawn from previous work, and brought out again the value of kainit in the control of weeds, especially wild mustard,

wild radish, and cornflower. Kainit was most effective when brought in contact with the plants when these were in the initial stages of development. It was not found desirable to delay the application beyond the appearance of the first flower buds of the weeds studied. The best results with reference to injuring the weeds and benefiting the crop were secured when application was made at the time the grain plants began to stool. It is pointed out that fertilizing with kainit before seeding is frequently of greater benefit to the weeds than to the crop, especially so in the case of rye fields infested with cornflower.

The statement is made that if the use of kainit is to be satisfactorily effective an adequate quantity must be applied when the plants are wet from dew or rain and the kainit solution must remain active on the parts of the plants above ground for a sufficient length of time. For weed control the use of about 1,300 lbs. of kainit per acre is recommended.

Iron sulphate and calcium cyanamid were generally less effective than kainit. The wild poppy proved most sensitive to calcium cyanamid, and in these tests a mixture of 668 lbs. of kainit and 67 lbs. of calcium cyanamid per acre proved more injurious to cornflower than double the quantity of each substance when applied alone.

HORTICULTURE.

The present status of vegetable breeding, E. von Tschermak (*Ztschr. Pflanzenzücht., 4 (1916), No. 1, pp. 65–104*).—The more important results of breeding investigations with different kinds of vegetables are reviewed. A bibliography of cited literature is included.

Fertilizer experiments with various vegetables on low moor land, Alves (*Mitt. Ver. Förd. Moorkultur Deut. Reiche, 33 (1915), No. 13, pp. 287–292*).—Fertilizer experiments with different kinds of vegetables conducted in 1914 under the direction of the German Society for the Promotion of Horticulture and the Association of German Vegetable Growers are reported.

Vegetable tests on sandy soil at the Umatilla Experiment Farm, R. W. Allen (*Oregon Sta. Bul. 136 (1916), pp. 3–38, figs. 9*).—This bulletin presents the results of variety and cultural tests of various vegetables conducted during the past six years. The subject matter is presented under two general crop divisions, namely, important vegetable crops and minor truck crops, the latter crops being poorly adapted to the district or of only secondary commercial importance. Included in the crops which are promising on account of their production and marketing possibilities are asparagus, eggplant, muskmelons, onions, parsnips, peas, potatoes, sweet corn, and watermelons.

The vegetable garden in New Hampshire, J. B. Scherrer (*N. H. Col. Ext. Bul. 6 (1916), pp. 42, figs. 20*).—The principles of vegetable gardening are here considered with special reference to their adaptation to the home garden and the small commercial garden.

Vegetable growing (*Mass. [Bd.] Agr. Bul. 5, 2. ed., rev. (1916), pp. 185, pls. 15, figs. 14*).—Some of the articles in the previous edition of this bulletin (E. S. R., 26, p. 539) have been superseded by new ones and a number of other new articles relating to vegetable growing have been added. The subject matter as a whole has been thoroughly revised and brought up to date.

Specific chemical and structural variations caused by grafting the tomato on the cabbage, L. Daniel (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 11, pp. 397–399*).—The variations here described consist of the development of granular cellules containing oxalate of lime in the cabbage and the occurrence in the cabbage throughout the region of the union of a well-developed internal medullary liber similar to that of the tomato.

The fruiting relations of various garden forms of Brassica oleracea, T. ROEMER (*Ztschr. Pflanzenzücht., 4 (1916), No. 1, pp. 125–141*).—The results are given of self and cross pollination experiments conducted in 1914 and 1915 with kale, kohl-rabi, Brussels sprouts, and cabbage.

Things to be emphasized in present day horticulture, U. P. HEDRICK (*N. Y. Dept. Agr. Bul. 74 (1915), pp. 2489–2501*).—A review of some results of experiment station work. Among the subjects considered are fertilizer experiments with apples, improving old varieties of fruits, cultural tests of European grapes, fruits resistant to insects and fungi, fruit stocks, methods of improving size, quality, and color in apples, and profits from an apple orchard.

Fruit growing in Spain, G. FERNÁNDEZ DE LA ROSA (*Bol. Agr. Téc. y Econ., 7 (1915), Nos. 80, pp. 733–742; 81, pp. 813–822; 82–83, pp. 921–939; 84, pp. 1013–1021*).—An economic study of the fruit industry in Spain with reference to its history, present status, and factors influencing its future development.

The sorting, sizing, packing, and storing of fruit, E. L. MARKELL (*Trans. Peninsula Hort. Soc. [Del.], 29 (1916), pp. 41–47*).—A popular paper on the handling and storing of apples in which some of the results are given of storage investigations conducted by the U. S. Department of Agriculture.

The act relating to the standardization of fruit packing, G. P. WELDON (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 4, pp. 125–128*).—The text is given of the California fruit-packing act which went into effect August 9, 1915.

Recent developments in sulphur sprays, J. P. STEWART (*Trans. Ill. Hort. Soc., n. ser., 49 (1915), pp. 186–198*).—In this paper the author gives special attention to the character of the materials used in sulphur preparations intended for spraying purposes.

Results of spraying experiments for 1915, Neoga station, Cumberland County, O. S. WATKINS (*Trans. Ill. Hort. Soc., n. ser., 49 (1915), pp. 202–221*).—In continuation of previous experiments conducted at Neoga (E. S. R., 35, p. 39), experiments were conducted in two orchards in 1915. The chief lines of investigation included tests of several proprietary sprays in comparison with Bordeaux mixture and lime-sulphur-arsenate of lead, a comparative test of several brands of arsenate of lead, tests of the effect of special sprays against codling moth infestation as applied at various times throughout the season, a comparison of certain standard nozzles, and a test of a dusting machine and dust sprays. The data secured are presented in tabular form and discussed.

In view of seasonal conditions the results as a whole were not favorable for drawing definite conclusions. The following conclusions, however, appear to hold good in any season. Blackleaf 40 should not be used with arsenate of lead without Bordeaux mixture or lime-sulphur, as it dwarfs the fruit. Niagara soluble sulphur in combination with arsenate of lead should not be used on apple trees, as the trees thus far sprayed with this combination have been seriously injured.

Intercropping the young orchard: From an economic standpoint, M. C. BURRITT (*N. Y. Dept. Agr. Bul. 74 (1915), pp. 2502–2511, fig. 1*).—A discussion of the cost of production in orcharding, with special reference to the use of intercrops to reduce this cost. Data are given showing the economic results of intercropping as practiced in the author's orchards.

Report of the horticulturist, A. G. TURNEY (*Rpt. Agr. New Brunswick, 1915, pp. 100–114, pls. 2*).—A progress report on the work of the horticultural division for the year 1915, including data on the cost of operations and returns secured in some demonstration apple orchards.

In view of the prevalence of apple scab in one orchard of 45-year-old Fameuse trees it was decided to top-work the trees to some other variety. Records were

kept and are here given showing the cost of top-working, as well as the amount of fruit harvested from top-worked trees as compared with similar ungrafted Fameuse trees. The total cost for one season in top-working these trees to another variety was $1.215 per tree.

An experiment was undertaken to determine whether apple scab could be controlled to any extent by removing and destroying the affected twigs before the spores had a chance to germinate. The trees received the usual spraying. The results, although not conclusive, indicate that the removal of the twigs does aid in checking the scab. In the three previous years the trees had been sprayed thoroughly without producing any marked improvement, whereas in the present season they produced nearly all clean fruit in one of the worst scab seasons for years. A similar experiment in removing and burning the fallen leaves early in the spring indicates that this practice is also successful in checking the scab.

The cherries of Japan, E. H. Wilson (*Pubs. Arnold Arboretum, No. 7 (1916), pp. XIV+68, pls. 8*).—This comprises an enumeration and description of the Japanese species of cherries. The work is based upon investigations conducted by the author in Japan, including studies of collected material and material preserved in the herbarium of the Imperial Botanic Garden, Tokyo.

Peach spraying experiments, 1915, Walter White orchard, near Centralia, Ill., O. S. Watkins (*Trans. Ill. Hort. Soc., n. ser., 49 (1915), pp. 198–202*).—Tabular data are given showing the value of different sprays used on a two-acre peach orchard at Centralia in 1915. The test included a number of brands of arsenate of lead, soluble sulphur, copper ferrocyanid, commercial lime-sulphur, and dust spray.

The grape industry in California (*Cal. State Bd. Vit. Comrs. Bul. 6 (1916), pp. 13*).—A statistical review of the grape, wine, and raisin industry in California for the year 1915, including some comparative data for 1914. A table is also given showing carload shipments of deciduous fruits.

Report of the National Congress of Viticulture, held at Pamplona, Spain, July, 1912 (*Mem. Gen. Ses. Cong. Nac. Vit., 1912, pp. XXXIX+559, pls. 5, figs. 19*).—This comprises a general account of the sessions of the National Congress of Viticulture at Pamplona, Spain, in July, 1912, together with the papers, some 50 in number, presented at the congress.

The more important themes discussed include methods of combating various insect pests and diseases; protection of vineyards from late frosts and other climatic disturbances; marketing problems; the culture of grapes in connection with other crops; the reconstitution of phylloxera-infested vineyards, including observations on various American stocks; direct-bearing grapes and hybrid direct-bearing grapes; adaptation of varieties to different types of soil; fertilizers; methods of pruning; methods of preparing and conserving wines; and methods of preventing the falsification of wines. Although the majority of the papers relate to Spanish conditions, a number of papers by French viticulturists and viticultural investigators were presented, together with papers on the viticultural industries in Hungary, Argentina, Chile, and Uruguay.

Grape growing in the Nasik District, H. V. Gole (*Dept. Agr. Bombay Bul. 71 (1915), pp. 25, pls. 5*).—A practical treatise on grape growing in the Nasik District, India, the subject matter being based largely on the author's experience in growing Vinifera grapes.

Renewing old citrus trees, A. D. Shamel (*Cal. Citrogr., 1 (1916), No. 7, pp. 2, 3, fig. 1*).—The author cites the beneficial results secured as to yield and quality of fruit when old apple trees are severely cut back. Attention is then called to the practice employed in Bahia navel orange groves in which the trees after 20 to 25 years begin to lose their power of producing profitable

crops. The old tops are removed at this period and new ones grown. It is claimed by the growers that the renewed trees produce larger and better fruits than the original bore at any time. A study of the performance records of the renewed trees appeared to confirm the statements of the growers. Special attention is called to the desirability of studying the effect of renewal of old navel trees in California in conjunction with the maintenance of individual tree records with reference to the time of pruning, the cultural treatments, amount of fruit produced, etc.

Ribbed Valencia sport, H. J. WEBBER (*Cal. Citrogr., 1 (1916), No. 7, p. 3, fig. 1*).—A description with illustrations is given of a variation of the Valencia orange in which the fruit is ribbed.

Preliminary results on budding and grafting experiments with cacao, H. VAN GENT (*Meded. Cultuurtuin [Buitenzorg], No. 5 (1915), pp. 9, pls. 5*).—Budding and grafting experiments conducted in the Buitenzorg gardens are reported.

Method in manurial experiments with trees (*Agr. News [Barbados], 15 (1916), No. 366, pp. 145–147*).—A brief description of methods employed in manurial experiments with coconuts and cacao trees in the West Indies and British Guiana.

Manurial experiments on coconuts, 1914–15, J. DE VERTEUIL (*Bul. Dept. Agr. Trinidad and Tobago, 15 (1916), No. 2, pp. 56–66, pls. 3*).—This report deals with the fourth year's results of manurial experiments with coconuts being conducted under the direction of the Trinidad Board of Agriculture (E. S. R., 32, p. 236).

Coconut experiments, C. H. KNOWLES (*Dept. Agr. Fiji Bul. 8 (1915), pp. 6, pls. 2*).—An outline is given of selection experiments with coconuts being conducted on Viti Levu, Fiji, including notes on the methods used in selecting seed nuts and brief descriptions of the varieties selected.

Germinating coconuts, O. F. COOK and C. B. DOYLE (*Jour. Heredity, 7 (1916), No. 4, pp. 148–157, figs. 6*).—An illustrated study of the germinating coconut.

The grafting of coffee, W. M. VAN HELTEN (*Meded. Cultuurtuin [Buitenzorg], No. 4 (1915), pp. 11, pls. 3, figs. 3*).—Methods of grafting coffee are described, and a list is given of the grafts of various varieties of imported coffees in the Buitenzorg gardens in 1914–15.

Growing melons on trees, J. E. HIGGINS (*Jour. Heredity, 7 (1916), No. 5, pp. 208–220. figs. 7*).—An account of the papaya with special reference to irregularities in sex and methods of breeding desirable types. The subject matter is based largely on the work of the author and V. S. Holt at the Hawaii Experiment Station (E. S. R., 30, p. 841).

Top-working pecan trees, E. J. KYLE (*Agr. and Mech. Col. Tex. Ext. Bul. B–21 (1916), pp. 7, figs. 6*).—Directions are given for top-working pecan trees by using different methods of budding.

Commercial production of thymol from horsemint (Monarda punctata), S. C. HOOD (*U. S. Dept. Agr. Bul. 372 (1916), pp. 12*).—As a result of selection experiments with horsemint (*M. punctata*), here briefly described, the author has been successful in securing an improved form more luxuriant in growth and with a higher thymol content than in the wild form. It is believed that the selection work has been carried far enough to warrant the use of this improved form for the commercial production of thymol in the United States. Cultural methods for horsemint are here discussed, together with methods of harvesting, distillation, and extraction of the thymol.

During the past five years areas up to one acre in extent have been grown on various soils. The results show that an average production of 20 lbs. of

oil, or about 12.86 lbs. of pure thymol, per acre from first-year plantings may be regarded as a fair crop. The estimated returns based on the work done thus far show that a profit of about $16 per acre may be expected as an average for a 5-year period. Hence, it is concluded that the production of thymol might be profitable when grown in connection with other oil-yielding plants for which a distilling apparatus is required.

Beautiful gardens in America, LOUISE SHELTON (*New York: Charles Scribner's Sons, 1915, pp. XVI+[87], pls. 135*).—An illustrated work in which are shown types of American gardens, covering all sections of the country. The aim has been to show those gardens which represent the development of the owner's ideal rather than imitations of foreign types of formal gardens.

Every woman's flower garden, MARY HAMPDEN (*New York: Duffield & Co., 1915, pp. IX+353, pls. 5, figs. 83*).—A popular treatise on ornamental gardening with suggestions relative to garden design and plants for different types of gardens.

Notes on new plants and plants not well known, W. HUNT (*Ann. Rpt. Hort. Socs. Ont., 10 (1915), pp. 57–64, figs. 2*).—This comprises a brief review of some of the newer or less-known plants that have been tested in the flower borders and grounds of the Ontario Agricultural College during the past five years. Special attention is given to those that have proved to be most adapted for the amateur's garden.

Popular hardy perennials, T. W. SANDERS (*London: W. H. & L. Collingridge, [1916], pp. [6]+410, pls. 17, figs. 242*).—This work deals with popular hardy perennials relative to their cultivation in beds, borders, the wild and woodland garden, and by the water side. The propagation of hardy perennials is also discussed, and descriptions given of the most attractive, useful, and easily grown genera, species, and varieties.

Breeding Nephrolepis ferns, S. BOSHNAKIAN (*Jour. Heredity, 7 (1916), No. 5, pp. 225–236, figs. 8*).—An account of the Nephrolepis ferns with reference to the development of different types of sports and methods of propagating and disseminating them.

The history, development, and propagation of the lilac, J. DUNBAR (*Ann. Rpt. Hort. Socs. Ont., 10 (1915), pp. 75–81*).—An address before the Horticultural Societies of Ontario, 1915, in which the author discusses the history of the lilac and the development of the present improved types. A selection is given of the most distinct varieties of lilacs.

Preliminary experiments in poppy breeding, R. RANNINGER (*Ztschr. Pflanzenzücht., 4 (1916), No. 1, pp. 45–64*).—The results are given of some breeding and selection experiments with poppies, conducted in 1914 and 1915.

The American rose annual, edited by J. H. MCFARLAND (*Harrisburg, Pa.: American Rose Society, 1916, pp. 153, pls. 10, figs. 7*).—This is the first of a series of annuals to be published by the American Rose Society. It discusses the aims and purposes of the society and contains articles dealing with varieties, the adaptation of the rose to extended uses, rose breeding, the literature of the rose, the enemies of the rose, rose gardens in different parts of the United States, the value of local rose organizations, cut flower rose growing, and the work of the American Rose Society. A partial list is given of American hybridized roses, with parentage and date of introduction so far as ascertainable.

The best hardy conifers, E. H. WILSON (*Gard. Mag. [N. Y.], 22 (1915), No. 5, pp. 145–150, figs. 18*).—Descriptive notes are given on a large number of hardy conifers adapted for ornamental planting.

FORESTRY.

Forestry handbook.—I, Forest principles and practice, edited by R. DALRYMPLE HAY (*Sydney: Govt., 1915, pp. 87, pls. 21, figs. 45*).—The present part of this handbook consists of a summary of useful information bearing upon the principles and practice of forestry in New South Wales. The subject matter is presented under the following general headings: General principles of forestry, climatic and protective influence of forests, afforestation, reafforestation, identification of timbers, measurement and mensuration (weight of timber, forest assessment and survey, forest working systems, and timber physics), a treatise on timber tests, and a summary of results.

A practical treatise on silviculture, A. JOLYET (*Traité Pratique de Sylviculture. Paris: J. B. Baillière & Sons, 1916, 2. ed., rev., pp. 724, figs. 130*).—This work comprises a completely revised edition of Traité Pratique de Sylviculture: Les Forêts, written by L. Boppe and the author, previously noted (E. S. R., 12, p. 756). The work has also been considerably enlarged.

Silviculture, E. MARSDEN (*Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 120–123*).—A brief statement of progress made in the more important silvicultural investigations during the year.

The selection strip-felling and its system, C. WAGNER (*Der Blendersaumschlag und sein System. Tübingen: H. Laupp'schen Buchhandlung, 1915, 2. enl. ed., pp. XII+382, pls. 2, figs. 75*).—The present edition of this work (E. S. R., 27, p. 444) has been revised and slightly enlarged.

The green book (*Bingham, Me.: Kennebec Valley Protec. Assoc. [1916], pp. 32, figs. 10*).—A manual for the use of lumbermen, woodsmen, and sportsmen containing the laws of the State of Maine relating to protection of the forests from fire and miscellaneous information of value in the woods.

Railroad fire prevention, W. T. COX (*Minn. Forest Serv. Bul. 2 (1914), pp. 29, figs. 18*).—This report takes up the different sections of the Minnesota forest laws relating to railroads and reviews the progress made in fire prevention under each section of the laws.

The torrents of Savoie, P. MOUGIN (*Les Torrents de la Savoie. Grenoble: Soc. Hist. Nat. Savoie, 1914, pp. XI+1251, pls. 69*).—In part 1 of this work the author discusses in detail the origin of the torrents in Savoie, consideration being given to the topography of the country, geology of the soil, climate, deforestation, and torrential legislation. Part 2 consists of monographs on the principal torrents of Savoie.

The importance of private forestry in Japan, O. SHISHIDO (*Jour. Col. Agr. Tohoku Imp. Univ., 7 (1916), No. 1, pp. 99*).—This paper gives an account of the past and present development of private forestry in Japan, discusses the economic importance both to the individual and to the State of the development of private forests, and suggests methods leading to the better development and utilization of these forests.

Extracts from the bulletin of the Forest Experiment Station, Meguro, Tokyo (*Tokyo, Japan: Bur. of Forestry, Dept. Agr. and Com., 1915, pp. II+221, pls. 34, figs. 4*).—The extracts here listed are from the bulletin of the Forest Experiment Station, Meguro, Tokyo, and are based on investigations made during the period from 1905 to 1914:

Investigation of Tree Seeds in Relation to the Producing Districts of the Mother Trees and Their Descent, by H. Shirasawa (pp. 1–14); Experiments on the Preservation of Principal Forest Tree Seeds, by H. Shirasawa and M. Koyama (pp. 15–27); Composition of Fallen Leaves of Forest Trees and Their Quantities (pp. 28–33), and The Proper Season for Application of Fertilizers

to Sugi (*Cryptomeria japonica*) and Hinoki (*Chamæcyparis obtusa*) Seedlings and the Efficacy of Fertilizers (pp. 36–41), by S. Moriya; Investigation of the Transverse Strength in Wood (pp. 42–54), and Determination of the Calorific Power of Wood (pp. 55–58), by K. Moroto; Experiment of the Electric Resistance in Wood, by J. Hiruma (pp. 59–65); Charcoal Burning in Japan (pp. 66–76), and Condensation of Wood Vinegar in Charcoal Burning in Japan (pp. 77–80); by S. Mimura; Tapping of Lac, by M. Moriya and H. Shirasawa (pp. 95–108); Notes on "Shiitake" (*Cortinellus shiitake*) Culture (pp. 109–114), Researches on the Culture of "Matsudake" (*C. edodes*) (pp. 115–122), and Researches on the "White Judas' Ear" (*Tremella fuciformis*) (pp. 123–126), by S. Mimura; Notes on the Analytical Interpretation of Growth Curves for Single Tree and Stands and on Application for the Construction of Yield Table for Sugi (*C. japonica*) (pp. 151–202), and Investigation on Form Height Tables for the Principal Conifers and Some Broad-Leaved Trees in Japan and Bases on Which They May Be Constructed (pp. 203–221), by W. Terazaki.

An inventory of Florida's forests and the outlook for the future, R. M. Harper (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 2, pp. 5–24, figs. 12*).—A survey of the forests of Florida with reference to the area and density of the forests, their distribution and character, frequency of fire in different types, composition, prevalence of species, rate of growth and composition, and the influence of fire and agriculture on the permanence of forests.

Biennial report of the forestry commission for the years 1913–14, W. R. Brown, J. E. Tolles, and B. F. Greer (*Bien. Rpt. Forestry Com. N. H., 1913–14, pp. 114, pls. 14*).—A progress report of operations conducted by the forestry commission, principally along the lines of forest fire protection, reforesting waste and cut-over land, acquisition and management of state forest lands, and educational work among woodland owners.

Report of the director of forestry for the year 1915, R. H. Campbell et al. (*Dept. Int. Canada, Rpt. Dir. Forestry, 1915, pp. 102, figs. 23*).—The report includes a review of the several lines of work carried on during the year, and detailed reports of the work of the tree planting division and on the forest reserves in the separate Provinces, together with the report of the Forest Products Laboratories of Canada.

Forest products of Canada, 1914.—Lumber, lath, and shingles, compiled by R. G. Lewis and W. G. H. Boyce (*Dept. Int. Canada, Forestry Branch Bul. 56 (1916), pp. 62, pl. 1*).—A statistical report on the production of lumber, lath, and shingles in the various Provinces of Canada during 1914, including information relative to the quantities of each species of wood used.

Economic forest products, C. E. C. Cox (*Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 124–132*).—A progress report for the year 1914–15 relative to investigations dealing with forest products.

DISEASES OF PLANTS.

Wound parasitism and predisposition, F. Heske (*Centbl. Gesam. Forstw., 40 (1914), No. 11–12, pp. 456–461*).—This is a discussion of the relations of host, parasite, enzym, etc., concluding with the statement that wound parasitism requires a real predisposition of the host plant to attack, consisting in an alteration of the natural state of the host as a primary or contributory condition. The situation as regards the plant may also be such as to render attack comparatively easy but yet not inevitable. This predisposition consists not only in the susceptibility of the plant, but may relate to influences acting upon the infective bodies also.

Report of the department of vegetable pathology and entomology, P. Cardin (*Estac. Expt. Agron. [Cuba], Informe An., 3 (1909–1914), pp. 98–173, pls. 5*).—This report, covering the period from July, 1909, to July, 1914, contains an account of insect pests and fungus parasites, the host plants being arranged in alphabetical order according to their native names in Spanish, with references to bulletins, circulars, etc., in cases in which they have been noted previously.

Smuts of grain and forage crops in Kansas, L. E. Melchers (*Kansas Sta. Bul. 210 (1916), pp. 3–38, figs. 20*).—After giving general statements regarding the amount of loss due to smuts, the author describes the important smut diseases in Kansas, grouping them under the headings of corn smut and head smut of the sorghums; kernel smut of the sorghums, stinking smut of wheat, smut of oats, covered smut of barley, and smut of millet; and the loose smuts of wheat and barley. These different cereal diseases are described at some length and suggestions given for their control.

In connection with the control of loose smut, the author urges the necessity for seed plats so isolated as to prevent infection.

Experiments on varietal resistance to the bean and cotton anthracnose diseases, C. W. Edgerton and C. C. Moreland (*Louisiana Stas. Bul. 155 (1916), pp. 24, figs. 4*).—A report is given of some experiments on the varietal resistance of beans and cotton to anthracnose diseases.

The experiments with beans were carried on in both the field and the greenhouse in 1914, in 1915 in the field, and in the winter of 1914–15 in the greenhouse, cultures of *Colletotrichum lindemuthianum* from different sections and from different varieties of beans being tested. As a result of their experiments the authors conclude that the bean anthracnose fungus is composed of different strains which affect different varieties of beans differently. Some varieties were susceptible to many different strains of the fungus, while others were resistant to some strains but susceptible to others. Some varieties of beans were found practically immune to some strains of the fungus. The reason for this behavior is attributed to the fact that the bean anthracnose fungus is not variable, and is unable to adjust itself to slight variations in the host plant, and as varieties of beans are said not to cross readily there are no intermediate forms, which would permit the specialization seen in the different strains.

The experiments with cotton anthracnose (*C. gossypii*) were conducted in the field, as it was impossible to grow a sufficient amount of cotton to maturity in the greenhouse. The data secured were obtained by natural infections in which the varieties were grown between rows of badly infected plants, and by artificial infections in which the flowers were inoculated with pure cultures of the anthracnose fungus. In the case of the experiments with cotton, the anthracnose fungus was found more variable and was able to adjust itself to variations in the host plant more readily than the bean anthracnose fungus. Cotton varieties were not found to show any marked variability in regard to their resistance to anthracnose. All the varieties tested seemed very susceptible to the disease, and, although in some cases slight differences were noted, these are not considered of importance.

A rust of Astragalus sinicus and two fungus diseases of mulberry, H. Nomura (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 9 (1911), pp. 37, 38*).—Descriptions are given of the supposedly new species of fungi, *Coryneum mori* and *Phoma niphonia* on *Morus alba*, and *Tuberculina nomuriana* on *A. sinicus*.

A new smut fungus on Arrhenatherum elatius, H. C. Schellenberg (*Ber. Deut. Bot. Gesell., 33 (1915), No. 7, pp. 316–328, pl. 1, fig. 1*).—A supposedly

new smut fungus is described under the name *Ustilago arrhenatheri*, in connection with abnormalities produced thereby on the host, *A. elatius*.

Studies on the dying out of pepper vines in the Dutch East Indies.—I, Summary of previous investigations, A. A. L. RUTGERS (*Dept. Landb., Nijv. en Handel* [*Dutch East Indies*], *Meded. Lab. Plantenziekten, No. 18* (*1915*), *pp. 28*).—A general survey is given of pepper culture in the Dutch East Indies, more particularly of pepper diseases of economic importance, with special mention of results reported by some investigators in this and neighboring regions. Mention is made of a wilt disease associated with the presence of a fungus in the wood vessels. In some regions nematodes have been found in the roots of the plant. The connection between the above mentioned parasites and the losses associated therewith has not yet been determined. Results obtained from studies at the government farm at Taliperamba (Madras) emphasize the importance of the method of manuring and cultivating in connection with the premature dying of pepper vines.

Bacterial rot of stored potato tubers, C. M. HUTCHINSON and N. V. JOSHI (*Mem. Dept. Agr. India, Bact. Ser., 1* (*1915*), *No. 5, pp. 113–135, pls. 5*).—It is stated that four species of bacteria are found to be concerned in the rotting of potato tubers in India. One of these, numbered but not named, is invariably present in the rotting tubers examined. Infection takes place from without, differing in this respect from that due to *Bacillus solanacearum*. Preventive measures include the avoidance of mechanical injury in handling, storing in dry, coarse sand after immersion in 2 per cent copper sulphate solution with subsequent drying and periodical inspection to prevent infection of sound tubers.

A pathological and physiological study of the black heart of potato tubers, E. T. BARTHOLOMEW (*Centbl. Bakt.* [*etc.*], *2. Abt., 43* (*1915*), *No. 19–24, pp. 609–639, pls. 3*).—The author's preliminary studies (E. S. R., 30, p. 149) have been followed up by further studies of the injury and its causation.

It is stated that black heart of potato is produced, not by a parasitic organism but by abnormal physiological changes. It may be produced artificially by subjecting the tubers to a temperature of from 38 to 48° C. (100.4 to 118.4° F.), the optimum being 42 to 44°, and the optimum period of time being 15 to 20 hours. All of the 16 varieties experimented with proved to be susceptible to this trouble, which may be prevented by supplying sufficient oxygen during the period of heating, for which purpose a constant stream of air is not sufficient. The tissues do not blacken if the potatoes are kept in an atmosphere devoid of oxygen after removal from the oven. Affected tubers, if not cut open, form after seven to ten days an increasing hollow in the center due to the shrinkage of the tissue. This can not be detected from an outside view. The colors produced, which range from light pink to coal black, are thought to be due to the presence of an oxidizing enzym, tyrosinase, and a chromogen, tyrosin, which interact in the presence of free oxygen and are found in both normal and abnormal tissues of the potato tubers. The amino acid content increases greatly during the period of heating. The discoloration is said to be due to the presence of a substance known as melanin or humin.

The formation of black heart may be prevented by proper ventilation and the maintenance of a temperature not above 35°.

Late potato blight in Iowa, A. T. ERWIN (*Iowa Sta. Bul. 163* (*1916*), *pp. 286–306, figs. 8*).—The result is given of an investigation of the late blight of potato, particularly with reference to the influence of moisture supply, humidity, and temperature. Three pronounced outbreaks of the late blight are reported to have occurred in Iowa during the past 45 years. These were in 1885, 1903, and 1915.

In studying the meteorological conditions in connection with outbreaks of this disease, the author claims that the climatic conditions in Iowa are generally unfavorable to such outbreaks, but that they sometimes cause serious loss. The climatic conditions under which late blight occurs in Iowa are a high degree of humidity with heavy dews and midsummer temperatures lower than usual. An excess of rainfall and a predominance of cloudy weather are predisposing factors.

Some notes are given on disease-resistant varieties, the spread of the disease through seed infection, storage qualities of infected potatoes, and the effect of time of planting on the degree of injury. Diseased potatoes, it is claimed, may be held in storage at a very slight loss from dry rot if the temperature is sufficiently low and the potatoes are taken out of storage only a short time before they are used. Early planting and the use of Bordeaux mixture are considered effective measures for preventing late blight in Iowa.

Straight head in rice, F. C. Quereau (*Louisiana Stas. Rpt. 1915, p. 31*).—The author gives a brief account of a disease or condition in rice which seems to occur on soils containing an abundance of vegetable matter. It is not definitely known whether the disease is due to physical conditions or to some specific organism. The only preventive treatment at present known is to delay the initial irrigation as long as possible, or, if necessary to irrigate because of weeds or grass, to drain the land about 15 days after the first flooding, allowing it to become perfectly dry. In a number of cases, this treatment is said to have prevented the condition designated as straight head.

A disease of sugar beets, P. Berthault (*Jour. Agr. Prat., n. ser., 28 (1915), No. 56, pp. 550, 551, figs. 2*).—It is stated that in the region around Paris and northward, industries dependent upon the sugar-beet crop have been considerably affected of late by the development of unusual virulence in the attacks of *Cercospora beticola*, which has previously appeared in this district but generally in mild form. Changes in coloration and inferior growth are associated with injuries to the leaf tissue.

Cercospora beticola attacking sugar beets, E. Saillard (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 1, pp. 47–49*).—The author discusses the unusual attacks by *C. beticola* on sugar beets in 1915 and the effects thereof on beet products, some of which were considerably altered in their proportions, as shown by comparative tables for 1915 and some earlier years.

A disease of sugar beets, A. Morvillez (*Jour. Fabric. Sucr., 56 (1915), No. 11, pp. 1, 2*).—The author considers the losses to the sugar-beet industry in 1915 as due primarily and largely to insufficient nutrition.

Sugar beet disease, P. Berthault (*Jour. Agr. Prat., n. ser., 29 (1916), No. 2, pp. 35, 36*).—The author, discussing the above contributions by himself, Saillard, and Morvillez, considers the attack by *Cercospora beticola* and the associated abnormal chlorosis as closely related phenomena, the latter being probably dependent upon the former.

Internal action of chemicals on resistance of tomatoes to leaf diseases, J. B. S. Norton (*Maryland Sta. Bul. 192 (1916), pp. 17–30, fig. 1*).—After reviewing the literature describing the effect of soil applications, direct injection, and the use of serums and toxins for the prevention of plant diseases, the author describes some experiments carried on in 1912 and 1913, in which about 50 chemicals were employed to determine their effect on infection of tomatoes by *Septoria lycopersici* and *Cladosporium fulvum*.

The plants were grown in paraffin-covered paper pots suspended in glass tumblers above solutions of different proportions of the various chemicals, their roots extending downward to the solution of the chemical, which did not come in contact with the soil.

In a few instances, there was some indication that concentrations lower than those causing injury might reduce the development of the leaf parasites to some extent. This was true of potassium nitrate, sodium acetate, morphine sulphate, calcium nitrate, copper sulphate, lime water, sodium tungstate, and potassium permanganate. In some cases there was less leaf disease developed, particularly in case of *S. lycopersici*, on the higher concentrations where these were not strong enough to cause injury, but in general the results were negative.

Some orchard diseases and their treatment, C. R. Orton (*Proc. State Hort. Assoc. Penn., 55 (1914), pp. 43–56, pls. 6*).—The author discusses some of the more destructive orchard diseases prevalent in Pennsylvania, the number of which has greatly increased during recent years, naming their several orchard and wild hosts, describing their symptoms, and pointing out various control measures. Those taken up are fire blight (*Bacillus amylovorus*), bitter rot (*Glomerella rufomaculans*), black rot (*Sphæropsis malorum*), apple rust (*Gymnosporangium juniperi-virginianæ*), orange rust of quince (*G. germinale*), and brown rot of peach, plum, and cherry (*Sclerotinia cinerea*), with mention of others of less importance.

Experiments with rust and Coryneum of fruit trees, A. Cadoret and A. Desmoulins (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 46, pp. 468–471*).—Discussing the characters, importance, and extension of these two diseases, also tests with remedial measures made or reported, the authors conclude that the higher concentrations of the sprays sometimes used are unnecessary, 2 per cent being considered as sufficient for Bordeaux mixture or neutral copper acetate. The materials added to the sprays to increase their capacity for spreading and adhesiveness do not appear to have been very successful except in case of gelatin added to copper acetate. Lime sulphur sprays are said to have been very inferior in their results to the preparations based on copper.

The development of perithecia in Venturia inæqualis, K. Killian (*Ber. Deut. Bot. Gesell., 33 (1915), No. 4, pp. 164–168, figs. 2*).—The author gives an account of his observations, so far as completed, on the developmental history, in relation to apple leaves, of *Fusicladium dendriticum* (the conidial stage of *V. inæqualis*) associated with apple and pear scab.

Influences affecting cherry culture, Sprenger (*Cultura, 27 (1915), No. 325, pp. 291–295*).—Among the conditions mentioned as influencing returns from cherry culture in southerly portions of the Netherlands are various biological, physiological, and weather conditions, and pathological fungi, including Monilia, Coryneum, *Valsa leucostoma*, and *Armillaria mellea*.

Common diseases of the grape, M. T. Cook (*New Jersey Stas. Circ. 55 (1916), pp. 3–8, figs. 2*).—Descriptions are given of some of the more common diseases of the grape and suggestions offered for their control.

A brief report is also presented of grape-spraying experiments in 1915, in which an early spraying was given certain plats, and the results contrasted with those from plats sprayed as in the general practice in that vicinity. The plats receiving the extra spraying were given six applications, the first early in May, while the others received five applications, beginning June 17. At harvest, rows were selected for measurement from the different plats, and those which had received the extra spraying in May yielded an average of 66.5 baskets, or 25 baskets per four rows more than those treated in the ordinary manner.

A vine disease due to a Hypochnus, A. Lendner (*Bul. Soc. Bot. Genève, 2. ser., 6 (1914), No. 4, pp. 104–106, fig. 1*).—A fungus described as *H. burnati* n. sp. is considered as secondarily parasitic or saprophytic on grapevines. It may be related to the lime content in the soil.

[Reports on grape downy mildew] (*Rev. Vit., 43 (1915), Nos. 1096, pp. 17, 18; 1097, pp. 31–33; 1098, pp. 48, 49; 1099, pp. 64–69; 1100, pp. 73–88; 1101, pp. 93–107; 1102, pp. 113–120; 1103, pp. 133–143; 1104, pp. 153–168; 1105, pp. 173–184; 1106, pp. 206–209; 1107, p. 229; 1108, pp. 233–242; 1109, pp. 253–260; 1110, pp. 278–285; 1111, pp. 296–301; 1112, pp. 316–322; 1113, pp. 336–338; 1114, pp. 350–356; 1116, pp. 388–392; 1117, p. 410; 1119, pp. 447–450; 1120, p. 465*).—This series of articles is made up of information and suggestions received during the latter part of 1915 from correspondents at numerous points in France and some in neighboring countries regarding the appearances, phenomena, and effects of grape downy mildew, and regarding such related or unrelated factors as insects, black rot, weather conditions, and susceptibility, with some discussion of experiences and observations during previous years.

Downy mildew in Aude, F. CAZENAVE (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 34, pp. 188–190*).—The author reports that 10 sprayings with Burgundy mixture containing 2 per cent copper sulphate applied during the period from May 12 to August 12 gave adequate protection against downy mildew.

Downy mildew on direct-bearing grapevines, S. OBIEDOFF, J. BAQUERO, and D. V. PEHLIVANOGLOU (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), Nos. 30, pp. 82–88; 31, p. 117, figs. 2*).—This is a report on the phases and degrees of recent attack by grape downy mildew on direct bearers which have been considered as nearly or quite immune to such attack. Only a very limited number, however, are said to have proved resistant.

Causes of success or failure of grape downy mildew, L. RAVAZ (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 32, pp. 125–130*).—The author discusses the employment of different concentrations and frequencies in the sprays used against grape downy mildew, and the probability of the development of a strain of this fungus more than ordinarily resistant to fungicides.

Treatment for downy mildew in rainy years, G. HÉRON (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 34, pp. 185–188*).—The author's observations are said to indicate that in years of heavy rainfall a solution of 2 to 3 per cent copper content is preferable to the usual strengths used in copper sprays. Of these sprays Burgundy mixture is preferred, especially in the acid form, which is said to maintain on leaves and fruits a certain amount of soluble copper. It is thought prudent to apply after heavy rains a simple treatment consisting of a 0.4 or 0.5 per cent solution of copper sulphate. It is suggested that cupric powders may also be profitably employed.

Copper fungicidal powders, H. FONZES-DIACON (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 28, pp. 37–41*).—It is claimed that acid powders contain copper soluble in water, which is capable of exercising immediate fungicidal action upon mildew spores, and also copper soluble in water containing carbon dioxid, which is also capable of acting upon the spores, but more slowly. Too high acidity may scorch both leaves and fruits. Neutral powders contain copper more or less readily soluble in rain water charged with carbon dioxid, giving a slower fungicidal effect. The alkaline powders do not seem to be effective in this regard.

The influence of temperature on decomposition in Bordeaux mixture, O. BUTLER (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 27, pp. 15–18, pl. 1*).—A discussion is given of differences in the properties and effects of Bordeaux mixture corresponding to variations in the composition, temperature during preparation, and age of the mixture.

Treatment of grapevines with hot water and hot sprays, L. SEMICHON (*Rev. Vit., 43 (1915), No. 1096, pp. 9–12*).—This is mainly a reply by the author to some criticisms of the claims regarding the real temperatures of hot water

when used as fungicide or insecticide as previously discussed (E. S. R., 32, p. 447; 34, pp. 50, 243).

Treatment of vines and vegetation with hot water, L. Semichon (*Rev. Vit., 43 (1915), No. 1118, pp. 413, 414, fig. 1*).—Results are presented in numerical and graphical form of the relation found to exist between the distance from the nozzle and the lowering of the temperature in case of sprays applied with nozzles of different kinds and sizes.

Theory of temperature change in hot sprays, A. Chauvigné (*Rev. Vit., 43 (1915), No. 1118, pp. 415–417, fig. 1*).—This article reports a study along lines similar to the above. It is stated that the lowering of the temperature is not constant throughout the length of the jet, the maximum rate of temperature decrease being attained at 20 cm. (7.8 in.) from the orifice of the nozzle in the experiments reported.

Theory and practice in regard to the cooling of hot sprays, L. Semichon (*Rev. Vit., 43 (1915), No. 1118, pp. 417–419*).—This is a discussion of the above notes, including supposedly variable unknown factors.

Brusca of olive, G. Pollacci (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 9 (1911), pp. 26–28*).—Two fungi described as new species on olive leaves are named *Coniothyrium oleæ* and *Septoria oleæ*.

Cacao and its local diseases, T. G. Ghofulpo (*Philippine Agr. and Forester, 4 (1915), No. 8, pp. 162–172*).—Giving the results of a study of cacao culture in the Philippines, particularly in the region around the College of Agriculture, the author discusses various cacao pests and diseases. The fungi which are found to be very commonly injurious are the Diplodia or Lasiodiplodia form of *Thyridaria tarda, Phytophthora omnivora, Nectria theobromæ,* and *N. bainii.*

Bordeaux mixture, if applied thoroughly and in time, is said to be very satisfactory for both fungus pests and insect enemies of cacao. Necessary or helpful conditions for successful cacao culture are general sanitation, seed selection, spacing, fertilization of the soil, early pruning, and destruction of affected parts.

Coconut bud rot, J. B. Rorer (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 4, pp. 129, 130*).—In a summary of a report on the work done to date in connection with bud rot, it is stated that experiments at Roxborough, Tobago, and Toco, Trinidad, indicate that frequent spraying with Bordeaux mixture can be relied upon to prevent serious attack by this disease if the crowns of the trees are not over 15 to 18 ft. from the ground. The infected portions are chiefly the bases of the leaves, the flower stalks, the spathes, and the whole of the soft upper portion of the stem.

The claim that *Bacillus coli* is the cause of bud rot is said to be undergoing tests.

A study of native coffee production, F. D. Luistro (*Philippine Agr. and Forester, 4 (1915), No. 8, pp. 153–161*).—This is a discussion of coffee culture in the Philippines, including the decrease during recent years in the output with its causes and their possible remedies, as manuring, pruning, and more particularly, spraying.

It is stated that experiments carried out in the Lipa and the Los Baños districts, where *Hemileia vastatrix* is said to be the most destructive coffee disease, show that a considerable saving was effected by the use of Bordeaux mixture. Pruning is said to lessen the degree of infection.

A brief bibliography is appended.

A coffee disease in Mexico, R. Farneti (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 9 (1911), pp. 36, 37*).—A disease of coffee in Cuicatlan, in the Mexican State of Oaxaca, is ascribed to a fungus described as *Cercospora herrerana* n. sp., which is contrasted with *C. coffeicola.*

A new Cylindrosporium, M. TURCONI (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 9 (1911), pp. 28–30*).—*C. pollacci* n. sp. is the name given to a fungus parasitic on *Ilex furcata.*

The hydropsy of Madake (Phyllostachys bambusoides), S. KAWAMURA (*Extracts from Bul. Forest Expt. Sta., Tokyo, 1915, pp. 127–130, figs. 4*).—Madake has recently been increasingly affected with a disease characterized by accumulations of water in the stem, especially the middle portions, but not in the uppermost internodes. The leaves gradually fall and the stem becomes weak and unfit for use. The symptoms and their alterations are described in some detail. The cause of the trouble has not been determined.

The red plague of Sugi (Cryptomeria japonica) seedlings, S. KAWAMURA (*Extracts from Bul. Forest Expt. Sta., Tokyo, 1915, pp. 131–133, fig. 1*).—It is stated that since the red plague of Sugi became known a few years ago in Japan, the trouble has spread until it has now been reported from various parts of the country. The symptoms of the disease are described.

The author's investigations since 1911 have led to the conclusion that the disease attacks only this plant and is confined to seedlings under five years of age. Of the three fungi noted in this connection, Pestalozzia appears to be usually associated with other fungi, mostly on old, decayed leaves, and Cercospora is still under investigation, so that this report is confined chiefly to a discussion of Phyllosticta. The fungus attacks first the lower and then the higher leaves, causing discoloration, and later the twigs, causing dark brown spots on the surface, and eventually killing the leaves, causing complete failure of growth.

A disease of immortel trees, J. B. RORER (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 4, pp. 128, 129*).—A disease affecting *Erythrina velutina* is described, in which the leaves show first a pale green, then a yellow color. This is followed by a dieback, the branches falling away gradually and the bare, dead trunk finally rotting and falling to the ground. This occurs in widely separated groups of from 10 to 20 or more trees. Often, though not always, the cacao trees under the dying immortel trees are affected in much the same manner. The trouble may be connected with insufficient drainage. No parasites have yet been shown to produce the disease, and the symptoms suggest root trouble, poor soil conditions, or bad water relations. Deep and thorough drainage appears to be the best means of control.

Hypoderma deformans, an undescribed needle fungus of the western yellow pine, J. R. WEIR (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 8, pp. 277–288, pl. 1, figs. 4*).—A technical description is given of *H. deformans* n. sp., which is said to cause a serious needle disease of the western yellow pine (*Pinus ponderosa*) in parts of Idaho, Washington, and Montana.

The fungus is said to be a true parasite, attacking the foliage of all age classes. The first sign of infection is usually a slight browning of the tips of the needles, or, in regions of heavy infection, the entire needle may assume a straw yellow color deepening to a brown on the first appearance of the apothecia. The terminal shoots do not attain their normal development, and witches' brooms are frequently produced.

The author considers this fungus a possible cause of disease in nurseries, although, up to the present time, it has not been found in the forest tree nursery. Cutting out and burning the infected parts or trees are recommended as means of control.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Animal guide; North American wild animals, C. K. REED (*Worcester, Mass.: Author, 1915, pp. 253, figs. 60*).—This small pocket guide includes descrip-

tions of 60 North American wild animals illustrated in color from original paintings by H. F. Harvey.

A list of British birds compiled by a committee of the British Ornithologists' Union (*London: British Ornithologists' Union, 1915, 2. rev. ed., pp. XXII+430*).—This is the second revised edition of the British Ornithologists' Union list, the first of which was published in 1883. Under each species are given the common name, synonymy, distribution in the British Isles, and general distribution. The appendixes include a list of species which have been recorded as having been found in the British Islands, but on evidence which the committee do not regard as entirely satisfactory; a list of names which in the opinion of the committee should be retained, together with the corresponding names under the Rules of Nomenclature as drawn up by the International Congress of Zoology at their successive meetings; and a discussion of the reasons for the change of old names or for the nonadoption of changes which have been advocated by recent authors, together with the method of fixation of the types of the various genera used in the list.

Birds of the Indian hills, D. Dewar (*London and New York: John Lane, 1915, pp. 264*).—The several parts of this popular work deal with the birds of the Himalayas, the common birds of the Nilgiris, and the common birds of the Palni Hills. The vernacular names of Himalayan birds and of Nilgiri birds are given in appendixes and a subject index is included.

The entomological and ornithological collector's handbook, J. Sinclair (*Los Angeles, Cal.: Author, 1915, pp. 80*).—A handbook of information for collectors.

Agricultural entomology, H. Osborn (*Philadelphia: Lea and Febiger, 1916, pp. IV+17–347, pl. 1, figs. 252*).—This work has been prepared for the use of students, farmers, fruit growers, and gardeners.

Insect pests of Lima beans in St. Vincent, S. C. Harland (*Agr. News [Barbados], 14 (1915), Nos. 352, pp. 346, 347; 353, p. 363*).—An undetermined Cryptorhynchus borer; the bean leaf roller (*Eudamus proteus*), held in check by parasites; an undetermined leaf blotch miner; and the larvæ of an undetermined moth are said to be the most important enemies of Lima beans in St. Vincent.

Insect pests of the orchards and gardens of Idaho and their control, W. C. Edmundson (*Idaho Sta. Bul. 87 (1916), pp. 30, figs. 12*).—A popular descriptive account with control measures.

The insects injurious to fruit trees, P. Lesne (*Jour. Agr. Prat., n. ser., 28 (1915), Nos. 41, pp. 312–314, pl. 1; 42, pp. 327, 328; 53, pp. 503–506, pl. 1; 56, pp. 555, 556*).—A general account of insects attacking fruit trees, accompanied by colored plates of the more important forms.

[Citrus insects in the Isle of Pines], F. S. Earle and J. M. Rogers (*San Pedro [Isle of Pines] Citrus Path. Lab. Ann. Rpt., 1 (1915), pp. 11–21, figs. 2*).—An account of the more important citrus insects and means for their control.

The locust borer (Cyllene robiniæ) and other insect enemies of the black locust, H. Garman (*Bien. Rpt. State Forester Ky., 2 (1915), pp. 32–63, pls. 21*).—The locust borer, an extended account of which by Hopkins has been previously noted (E. S. R., 18, p. 159), is said to occur throughout Kentucky, its numbers being in proportion to the abundance of locust trees. Biological observations of this beetle and its natural enemies are reported.

It is pointed out that since the adults are dependent on goldenrod pollen and are abundant only where it may be secured, the destruction of goldenrod in the vicinity of plantings or the spraying thereof with arsenate of lead about the middle of September are valuable means of lessening the injury. As a

further precaution the spraying of the trunks of trees with lead arsenate about the first of September when the beetles begin to emerge from the trees is suggested and the destruction of old badly-infested locust trees in the vicinity of plantings is recommended.

The other insects mentioned as infesting the wood of the trees include the carpenter moth (*Prionoxystus robiniæ*), the twig miner (*Ecdytolopha insiticiana*), and *Agrilus egenus*. Several insects mentioned as attacking the young twigs and leaves include the leaf miners, *Chalepus dorsalis*, *C. nervosa*, *Gracilaria lespedezæfoliella*, *Lithocolletes ostensackenella*, and *L. robiniella*; the locust leaf skeletonizer (*Gelechia pseudacaciella*); and the locust skipper (*Eudamus tityrus*). Under the heading of puncturing insects several treehoppers, etc., are mentioned.

Twenty-eighth report of the state entomologist on the noxious and beneficial insects of the State of Illinois, S. A. Forbes (*Rpt. State Ent. Ill., 28 (1915), pp. IX+106, pls. 4, figs. 24*).—This report consists of the following papers: Recent Illinois Work on the Corn Root Aphis and the Control of Its Injuries (pp. 1–62) (E. S. R., 33, p. 60), Observations and Experiments on the San José Scale (pp. 63–79) (E. S. R., 33, p. 452), and Life History and Habits of the Northern Corn Rootworm (*Diabrotica longicornis*) (pp. 80–86) by S. A. Forbes; and the San José Scale (*Aspidiotus perniciosus*), by P. A. Glenn (pp. 87–106) (E. S. R., 34, p. 162). The paper on the northern corn rootworm is based upon miscellaneous observations and operations of several years.

Forty-fifth annual report of the Entomological Society of Ontario, 1914 (*Ann. Rpt. Ent. Soc. Ontario, 45 (1914), pp. 152, figs. 27*).—This annual report consists of Reports on Insects of the Year, by A. Gibson (pp. 13–28); Applied Entomology in Canada: Its Rise and Progress, by C. G. Hewitt (pp. 29–41); Insects of the Season in Ontario, by L. Caesar (pp. 42–49); The Habits of Spiders, by J. H. Comstock (pp. 49, 50); Brief Notes on Some of the Injurious Insects of Quebec, 1914, by W. Lochhead (pp. 59–61); Insects Injurious in Southern Quebec, 1914, by C. E. Petch (pp. 70, 71); The 1914 Outbreak of the Army Worm in Canada, by A. Gibson (pp. 72–75), substantially noted (E. S. R., 35, p. 56); The Army Worm in Ontario in 1914, by A. W. Baker (pp. 75–90); Experiments with Poisoned Bran Baits for Locust Control in Eastern Canada, by A. Gibson (pp. 97–102), substantially noted (E. S. R., 35, p. 56); An Imported Red Spider Attacking Fruit Trees, by L. Caesar (pp. 102–107) (E. S. R., 33, p. 659); Cherry Fruit Flies, by L. Caesar (pp. 107–112), substantially noted (E. S. R., 33, p. 561); The Control of Forest and Shade Tree Insects of the Farm, by J. M. Swaine (pp. 112–116); etc.

The theory of wetting, and the determination of the wetting power of dipping and spraying fluids containing a soap basis, W. F. Cooper and W. H. Nuttall (*Jour. Agr. Sci. [England], 7 (1915), No. 2, pp. 219–239, figs. 3*).—An extended discussion of the subject, including a review of the literature and a list of 20 references.

Common spray materials and other insecticides, J. G. Sanders (*Wis. Dept. Agr. Bul. 3 (1916), pp. 22, figs. 9*).—This is a popular treatise.

Locusts or grasshoppers, F. W. Urich (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 4, pp. 120–128, pl. 1*).—Brief notes are given on the occurrence of locusts in Trinidad and methods of combating them, together with an account of locust destruction in South Africa.

Combating locusts, Trabut (*Bul. Agr. Algérie, Tunisie, Maroc, 21 (1915), No. 3, pp. 53–74, figs. 16*).—A discussion of the methods of combating migratory locusts and of their natural enemies.

Thrips oryzæ n. sp., injurious to rice in India, C. B. Williams (*Bul. Ent. Research, 6 (1916), No. 4, pp. 353–355, fig. 1*).—This species is reported to be injurious to young rice.

What cacao thrips signify in Grenada, H. A. Ballou (*Agr. News [Barbados], 14 (1915), No. 350, pp. 314, 315*).—The cacao thrips (*Heliothrips rubrocinctus*) probably occurs in all parts of Grenada, where it was first found in 1898, and may occur in every cacao field. Attacks occur year after year on the same areas, on the same trees even, sometimes spreading a little, but a thrips area one year is liable or certain to be a thrips area every year, although it may never increase in numbers sufficiently to attract attention or cause any injury.

It is suggested that the cacao thrips should be considered a useful insect since it may indicate that the trees are suffering from untoward condition, thus serving as an indicator. When thrips areas have been examined, it has been found that root disease was present, the drainage was insufficient, the soil was shallow with terrace or heavy clay beneath, or there was evidently a lack of humus in the soil.

A new thrips damaging coffee in British East Africa, C. B. Williams (*Bul. Ent. Research, 6 (1915), No. 3, pp. 269–272, fig. 1*).—*Diarthrothrips coffeæ* n. g. and n. sp. is said to have caused serious damage to the leaves of coffee in several districts of British East Africa.

Egg and manner of oviposition of Lyctus planicollis, T. E. Snyder (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 7, pp. 273–276, pls. 4*).—Species of the genus Lyctus are said to be by far the most important of the various beetles which cause the so-called "powder-post" injury to seasoned wood products so widely distributed over the world. The observations of *L. planicollis* here described were made at Washington, D. C., and Falls Church, Va.

The winter is passed in the larval stage, general pupation occurring about the first of April; the pupal cell is excavated near the surface of the wood, and to this cell the larvæ retreat after cutting a transverse burrow nearly to the surface for the exit of the adults. The general emergence of adults takes place during May. Oviposition began a few days after mating and was observed to take place principally during the middle of May in 1915. On May 24 many beetles were observed on radial sections of wood with their ovipositors deeply inserted into the open pores or large longitudinal vessels in the wood. The beetles seem to prefer to oviposit on those sections of seasoned sapwood where the open ends of pores are most numerous. Recently hatched larvæ were first observed on June 1, the period of incubation being 10 days at most.

It is stated that the injury by "powder-post" beetles to unfinished seasoned wood products can be prevented by simply adapting a system of inspection, classification, and methods of disposal of stock to facts in the seasonal history of the insects, as has been recommended by Hopkins (E. S. R., 24, p. 256). In the case of finished wood products it may often be practicable to treat the wood with substances to prevent attack. Judging from the facts in the seasonal history of this species, preventives should be applied before March 1.

The mealy bug of the muscat grape, F. K. Howard (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 2, pp. 67, 68, fig. 1*).—The infestation of table and wine grapes in the grape-growing section of the San Joaquin Valley by the mealy bug, probably *Pseudococcus bakeri*, first became of economic importance in 1914. It was first found on raisin grapes in an old muscat vineyard near Armona, Kings County, Cal., in September, 1915. Up to the time of writing no satisfactory control measure had been worked out.

Phylloxera (*Dept. Agr., Indus., et Com.* [*Vaud*], *Raps. Sta. Vit. et Serv. Phylloxérique, 1912, 1913, and 1914, pp. 64, each*).—Reports on the reconstitution of vineyards and control work with phylloxera in the Canton of Vaud.

Notes on Samoan Coccidæ with descriptions of three new species, R. W. DOANE and G. F. FERRIS (*Bul. Ent. Research, 6* (*1916*), *No. 4, pp. 399–402, figs. 3*).—Notes are given on the occurrence of Coccidæ in Samoa, together with descriptions of three species new to science.

On a new coccid pest of cacao from Trinidad, E. E. GREEN (*Bul. Ent. Research, 6* (*1916*), *No. 4, pp. 377–379, figs. 3*).—*Philephedra theobromæ* n. sp., collected on pods of *Theobroma cacao* in Trinidad and attended by the ant *Azteca chartifex*, is described as new.

On a coccid injurious to pine trees in the Himalayas, E. E. GREEN (*Bul. Ent. Research, 6* (*1916*), *No. 4, pp. 395–397, pl. 1, figs. 3*).—*Ripersia resinophila*, which was found to occupy gummy cells of growing shoots of *Pinus longifolia* and *P. excelsa*, is described as new to science.

The soft bamboo scale (Asterolecanium bambusæ), E. O. ESSIG (*Mo. Bul. Com. Hort. Cal., 5* (*1916*), *No. 2, pp. 72, 73, fig. 1*).—The author records the discovery of the establishment of this pest in the United States for the first time, at Ventura, Cal., in March, 1914, and at Sierra Madre in 1915.

How to control the cottony maple scale, J. G. SANDERS (*Wis. Dept. Agr. Circ. 2* (*1916*), *pp. 4, figs. 3*).—A brief popular account.

Studies of comparative lepidopterology, C. OBERTHÜR (*Études de Lépidoptérologie Comparée. Rennes: Author, 1913, Nos. 7, pp. 679, pls. 171; 8, pp. 88, pls. 40; 9, pt. 1, pp. 44, pls. 9; 1914, No. 9, pt. 2, pp. 180, pls. 56, figs. 6; 1915, No. 10, pp. 459, pls. 152, figs. 42*).—A continuation of the work previously noted (E. S. R., 28, p. 453).

Life-histories of Indian insects.—V, Lepidoptera, C. C. GHOSH (*Mem. Dept. Agr. India, Ent. Ser., 5* (*1914*), *No. 1, pp. 72, pls. 9, fig. 1*).—This part (E. S. R., 31, p. 159) deals with the butterflies.

A butterfly injurious to coconut palms in British Guiana, L. D. CLEARE, JR. (*Bul. Ent. Research, 6* (*1915*), *No. 3, pp. 273–278, pls. 3, fig. 1*).—The larva of the coconut butterfly (*Brassolis sophoræ*) is reported to have severely attacked coconut palms in the vicinity of Georgetown during 1914. All of the green parts of the leaves were devoured, only the thick central midrib and the fine lateral veins being left. Studies of its histology, natural enemies, etc., are reported.

The possibilities of sericiculture in British colonies and dependencies, with special reference to the rearing of wild and semiwild silkworms (*Bul. Imp. Inst.* [*So. Kensington*], *13* (*1915*), *No. 1, pp. 87–110*).—An extended discussion.

The potato moth (Phthorimæa operculella [Lita solanella]).—Recent spraying experiments in Gippsland, C. FRENCH, JR., and S. G. HARRIS (*Jour. Dept. Agr. Victoria, 13* (*1915*), *No. 10, pp. 614–618, figs. 2*).—This pest has caused considerable loss to growers and is deemed the worst potato pest in Victoria. Due to exceptionally dry weather in Gippsland and elsewhere during the past two seasons, the moths have been exceedingly abundant and the damage caused has been very great. In some cases the whole crop has been destroyed when the plants were from 4 to 6 in. high, and in many instances the growers had to discard fully two-thirds of the tubers when bagging, owing to the depredations of the caterpillars. Experimental applications of lead arsenate to the foliage are said to have given quite beneficial results.

The grape berry worm (Polychrosis viteana), W. H. GOODWIN (*Ohio Sta. Bul. 293* (*1916*), *pp. 259–307, figs. 39*).—This lepidopteran, described from the United States in 1860 as *P. viteana*, resembles the European grape pest *P. botrana* anatomically, although the differences in its life history and habits

and minor anatomical differences have led to its recognition as a distinct species. It has been unusually destructive at various times in those sections of New York, Pennsylvania, and Ohio where grapes are the predominating crop, and has also been a pest in other States.

The studies of its life history and of control measures, here reported, have extended over a period of several years. The pest was found to be two-brooded, completing its life cycle twice each year. Moths transforming from the overwintering pupæ emerge throughout a period of from 20 to 30 days in June and July, making the periods during which the eggs hatch of equal duration.

"Earlier publications have recommended three sprayings, one just before bloom, a second when the grapes are about as large as peas, and a third about July 10 to 15. The recent and complete life-history studies have shown that by following this program the three sprayings for berry-worm control were made before the first-brood larvæ were grown. The third spraying from July 10 to 15 was made almost a month before the eggs of the second brood of berry worms for the season were hatched, leaving small probability of sufficient poison adhering at this time to kill many of these newly-hatched worms.

"By timely, thorough spraying, in accordance with the known life-history development, the berry worms have been controlled, their injuries being reduced to an almost negligible amount. These sprayings should be extremely thorough. Arsenate of lead 4 lbs., Bordeaux 2:3:50, and 2 lbs. of dissolved soft soap should be used for the first spraying just after the blooming of the grapes, when the largest berries are about 0.125 in. in diameter. This poison spray kills many of the first-brood worms.

"The second spraying must be made just preceding the placing of the moth eggs on the grape berries and stems of the berries. In normal years the time of this spraying comes between August 3 and 12, depending upon whether the grapes bloom earlier or later than normally, or about seven weeks after the grapes bloom. This time can also be determined by placing a lot of wormy grapes in a jar about July 20 with leaves on top of the berries; tie a piece of cloth over the top of the jar and place it outdoors in the shade. Spraying for the control of the second-brood worms must be started about ten days after the first-brood worms begin to spin cocoons on the grape leaves. Use arsenate of lead paste 6 lbs., Bordeaux 2:3:50, and dissolved soft soap 2 lbs., covering every bunch with spray, applying it preferably by hand."

Life-history studies of this insect, by Johnson and Hammar, have been previously noted (E. S. R., 28, p. 453).

Ornix geminatella, the unspotted tentiform leaf miner of apple, L. Haseman (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 8, pp. 289–296, pl. 1*).—This leaf miner is said to have been extremely abundant in Missouri in recent years, and has attracted the attention of fruit growers throughout the State. Its attack has largely been confined to bearing apple orchards, though considerable injury has been done to apple foliage in nurseries. Its importance is considerably lessened due to its being most abundant in the late summer and early fall.

The moth was first described and figured by Packard in 1869 as *Lithocolletes geminatella* and was reported by him to be abundant in New England on pear and apple. It has since been reported by entomologists as very abundant on apple in New York, as common in Connecticut, and as occurring in a number of other States.

In the present paper the author reports observations being made at the Missouri Experiment Station of its life history and habits. The egg is so small that

the author has failed to detect it on foliage. The larva always seems to break through the part of the shell which is cemented to the leaf and enters the leaf tissue at once. In the course of its development the larva molts three times, the first of which takes place on the third day and the second on the seventh or eighth day, the larval life in the mine being about two weeks. After vacating the mine through a small hole in its floor the larva crawls about for a varying length of time before making a cocoon in which to pupate. The cocoon is almost invariably placed on the upper surface along the edge of the leaf or at its very tip. Pupation takes place soon after the cocoon is completed, the pupal period varying from a few days to a week in midsummer. In the spring the adults are abundant by the first week in May. By the middle of the month the typical tentiform mines begin to appear, and the adults of the first spring brood begin to emerge by the last of May, the life cycle being completed in from four to five weeks. The broods overlap, but beginning with May a fairly well-defined brood can be made out for each month until November. The larvæ of the October brood pupate and live through the winter on fallen leaves.

While this leaf miner is primarily a pest of the foliage of the apple, the small caterpillars have also been found developing in considerable numbers in the leaves of the crab apple and occasionally in the leaves of the haw (*Cratægus* spp.), plum, cherry, and pear. Other authors report having reared it from mines in the leaves of wild cherry.

It is pointed out that since the caterpillar enters the leaf immediately on hatching and remains in the mine until mature and ready to spin its cocoon for pupating, arsenical and contact sprays are of little value in its control. Since it passes the winter as a pupa in cocoons on fallen leaves, it can be effectively controlled by destroying the leaves early in the spring, the most practical method being to use a disk for shallow cultivation before the first of March so as to work under the leaves before the moths begin to emerge. The pest is said to be heavily parasitized. The author reared a number of parasites from it, namely, *Sympiesis nigrifemora*, *S. tischeriæ*, *S. meteori*, *Eulophus lineaticoxa*, *S. dolichogaster* and others which have not been identified.

Cutworms, H. T. Fernald (*Massachusetts Sta. Circ. 61 (1916), pp. 2*).—A revision of Circular 43, previously noted (E. S. R., 32, p. 349).

Anopheles punctipennis, a host of tertian malaria, W. V. King (*Amer. Jour. Trop. Diseases and Prev. Med., 3 (1916), No. 8, pp. 426–432, pl. 1*).—Substantially noted from another source (E. S. R., 34, p. 358).

In a footnote the author states that it has been established that *A. punctipennis* is also an efficient host of the parasite of estivo-autumnal malaria, *Plasmodium falciparum*.

Experiments on the development of malaria parasites in three American species of Anopheles, W. V. King (*Jour. Expt. Med., 23 (1916), No. 6, pp. 703–716, pls. 8*).—This is a report of further experiments (see above) with the three most prevalent species of the genus occurring in the United States.

"As a result of these experiments *Anopheles punctipennis* is shown to be an efficient host of the organisms of tertian and estivo-autumnal malaria, *A. crucians* of estivo-autumnal malaria, at least, and information has been obtained upon the relative susceptibility of these two species and *A. quadrimaculatus*. The latter species has been known to be an efficient host since Thayer's experiments in 1900, and has been considered to be the principal species concerned in the transmission of malaria in the United States.

"With *A. punctipennis*, developmental forms of the exogenous or sporogenic cycle of *Plasmodium vivax* were demonstrated in six (85 per cent) of the

seven mosquitoes dissected, and the development of *P. falciparum*, in four (20 per cent) of twenty specimens. These four infections, however, occurred in a series of thirteen specimens fed on one person, so that the percentage was actually 33.

"With *A. crucians*, oocysts or sporozoites or both oocysts and sporozoites of *P. falciparum* were found in nine (75 per cent) of the twelve specimens dissected. No tests were made with this species and *P. vivax*.

"*A. quadrimaculatus* was employed as a control species in the experiments and became infected in the following ratio: Eight (66 per cent) of twelve specimens with *P. vivax*, and three (15 per cent) of nineteen specimens with *P. falciparum*.

"In determining the relative susceptibility of the three species only those individuals which had fed upon the same gamete carriers are considered. The number of mosquitoes from which the percentages are computed is too small to make the results entirely conclusive."

A bibliography of 15 titles is appended.

Anopheles punctipennis.—Its relation to the transmission of malaria; report of experimental data relative to subtertian malarial fever, M. B. Mitzmain (*Pub. Health Rpts.* [*U. S.*], *31* (*1916*), *No. 6, pp. 301–307*).—"Two hundred and nineteen specimens of *A. punctipennis* were dissected from 3 to 38 days after multiple bites on individuals whose blood contained varying numbers of subtertian gametocytes (estivo-autumnal crescents). No infection was observed in the dissection of stomachs and salivary glands.

"Two healthy individuals were bitten 91 and 180 times by specimens of *A. punctipennis*, 4 to 33 days after sucking blood of a subtertian malarial carrier. In this experiment, and subsequently in the employment of a healthy volunteer to feed 22 additional mosquitoes of this same species, *A. punctipennis* could not be incriminated in the transmission of subtertian malarial fever. The negative results in this experiment check only with the negative findings in the dissections of *A. punctipennis*, as it is recognized that the volunteers were not under absolute control; that is, because of the possible exposure to bites from infected anophelines while living in New Orleans.

"Control feedings with 74 specimens of *A. quadrimaculatus* resulted in an infection of 13.8 per cent, and with three specimens of *A. crucians* of 33.3 per cent. The coincidence in which one person developed subtertian malaria 11 days following the single bite of an *A. quadrimaculatus* that had become infected (as shown by dissection) 17 days previously by biting a heavily infected carrier, pointed strongly to this as the source of infection. This might be offered as an additional check in the experiment, recognizing, however, the limitations that might be placed on it because of lack of absolute control of the volunteer living in New Orleans."

Observations on the Culicidæ, B. Galli-Valerio (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 76* (*1915*), *No. 4, pp. 260, 261*).—This note relates to the hibernation, biology, and breeding places of Culicidæ in Switzerland.

Observations on the bionomics of Stegomyia fasciata, J. W. S. Macfie (*Bul. Ent. Research, 6* (*1915*), *No. 3, pp. 205–229*).—Notes on the author's observations of the yellow fever mosquito, relating to length of life, blood feeding, ovulation, intolerance of the larvæ to common salt, etc., much of which data is presented in tabular form.

A note on treatment of swamps, stream beds, ponds, wells, pools, and other mosquito infested areas for the destruction of their larvæ, H. C. Wilson (*Madras: Madras Fisheries Bur., 1914, pp. 14, pls. 8*).—A note on mosquito control work in India.

Some new neotropical Simulidæ, F. Knab (*Bul. Ent. Research, 6 (1915), No. 3, pp. 279–282*).—Three species, namely, *Simulium sanguineum* from Columbia, *S. limbatum* from British Guiana, and *S. placidum* from Trinidad, are described as new to science.

Flies: A factor in, a phase of, filariasis in the horse, F. E. Place (*Vet. Rec., 28 (1915), No. 1418, pp. 120–125*).—The author attempts to trace a direct connection between the existence of certain flies, notably *Stomoxys calcitrans*, *Musca domestica*, and *M. vetustissima*, and the presence of certain filariæ in the stomach of the horse.

Chemical reactions of fruit flies, F. M. Howlett (*Bul. Ent. Research, 6 (1915), No. 3, pp. 297–305, pls. 4*).—"There are certain smells remarkably attractive to male flies of the genus Dacus and by the employment of these smells the movements of the flies can to a great extent be controlled in any given direction. The reaction is strictly confined to the male sex, and different species exhibit a variation as regards the smell which is most attractive to them. It is uncertain whether the females emit similar smells; on the whole improbable."

Effect of cold storage temperatures upon the pupæ of the Mediterranean fruit fly, E. A. Back and C. E. Pemberton (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 7, pp. 251–260, figs. 2*).—In the investigations here reported the authors, assisted by H. F. Willard, conducted extensive experiments to determine the effect of the various ranges of temperatures used in commercial cold storage plants upon the pupæ of the Mediterranean fruit fly. The work was carried on in connection with that relating to the effect of cold upon the eggs and larval instars, previously noted (E. S. R., 34, p. 554).

In the introduction the authors call attention to the fact that while the greatest danger in the spread of this pest from one country to another lies in the transportation of the larvæ within fruits, it is possible that the pest may also be transported in the pupal stage and arrive at its destination in a condition to produce infestation. It is stated that nearly all the experimental work with temperatures lower than 45° F. was carried on in a thoroughly modern cold storage plant.

The data presented, much of which are given in tabular form and include observations on 173,318 pupæ, indicate that none survive refrigeration for longer periods than are necessary to cause the death of the eggs and larvæ in host fruits held at corresponding temperatures. "About 50° is the critical point below which development can not take place and below which death will follow if refrigeration is continued sufficiently long. At 49 to 51° only 9 out of 39,500 pupæ yielded adults in refrigeration 20 to 47 days after the inward date, while 3 out of 6 held at 52 to 56° yielded adults in refrigeration 38 to 52 days after the inward date. Many pupæ can complete their entire development in refrigeration at 54 to 57°, while higher temperatures, not considered here, merely retard development without causing noticeable mortality.

"Pupæ can not withstand temperatures below 50° for prolonged periods of time. Only 3 and 1 pupa survived refrigeration for 8 and 9 days, respectively, at 32°, while none of 4,500 pupæ survived 10 days at this temperature. Refrigeration at a temperature averaging 34°, but ranging between 33 and 36°, proved fatal after the seventeenth day; 6,017 pupæ refrigerated at this temperature for 18 and 25 days yielded no adults, while the number to yield adults after refrigeration for 14 and 17 days was very small. No pupæ survived refrigeration at 28 to 40°, but averaging 36°, for more than 10 days. A temperature of 38 to 40° proved fatal after the nineteenth day; 30,731 pupæ refrigerated for from 21 to 35 days failed to yield adults on removal to normal temperatures. After refrigeration at 40 to 45° pupæ from each of two lots

removed after refrigeration for 24 and 27 days, respectively, yielded adults; 500 pupæ removed after refrigeration for from 31 to 34 days proved to be dead.

"It does not seem safe to conclude that the age of the pupa has a direct bearing upon its ability to withstand the more ordinary ranges of cold-storage temperatures."

The bean maggot in 1915, D. B. WHELAN (*Michigan Sta. Circ. 28 (1916), pp. 3, 4*).—Serious damage was done by the bean or seed-corn maggot in Huron, Sanilac, Tuscola, Saginaw, Gratiot, Eaton, and Berrien counties in Michigan during 1915, previous to which year it had appeared in scattered numbers over quite a large area and the damage had been comparatively slight. Instances are reported of fields in which the loss of plants varied from 50 to 80 per cent. Examinations of a series of bean fields beginning on July 1 showed that the maggots had been present in the fresh manure, clover sod, and the rotting stems of clover, and had transferred their attention to the beans. The eggs are usually deposited on the stems of the plants just coming through the soil or on decaying vegetable matter.

It appears that cultural methods furnish the best means for combating this maggot. Land which is in clover or is covered with manure should be plowed early and prepared, so that the soil will be in good condition and the maggots given time to disappear before the beans are sowed. "Commercial fertilizers may be substituted for barnyard manure when the necessity for late fitting of the soil demands it, and repeated harrowing and perhaps rolling, especially when the ground is light in texture, seem to aid."

The adaptative forms of anthomyid larvæ; Anthomyidæ, the larvæ of which are carnivorous, D. KEILIN (*Bul. Soc. Ent. France No. 20 (1914), pp. 496–501, figs. 3; abs. in Ent. Mo. Mag., 3. ser., 1 (1915), No. 8, pp. 242, 243*).—In continuation of investigations of dipterous larvæ the author, in dealing with the Anthomyidæ, refers to larvæ with saprophagous, phytophagous, parasitic, and carnivorous habits.

A catalogue of Coleoptera (*Coleopterorum Catalogus. Berlin: W. Junk, 1913, pt. 56, pp. 223; 1914, pts. 57, pp. 289–408; 58, pp. 65; 59, pp. 215; 60, pp. 62; 61, pp. 16; 62, pp. 182; 1915, pts. 63, pp. 84; 64, pp. 14; 65, pp. 82*).—In continuation of this work (E. S. R., 30, p. 458) part 56, by A. Grouvelle, catalogues the Byturidæ and Nitidulidæ; part 57, by M. Bernhauer and K. Schubert, the Staphylinidæ, IV; part 58, by M. Pic, the Dascillidæ, Helodidæ, and Eucinetidæ; part 59, by H. Clavareau, the subfamily Eumolpinæ of the Chrysomelidæ; part 60, by R. Jeannel, the subfamily Bathysciinæ of the Silphidæ; part 61, by A. Méquignon, the Rhizophagidæ; part 62, by F. Spaeth, the subfamily Cassidinæ of the Chrysomelidæ; part 63, by E. Csiki, the Mordellidæ; part 64, by S. Schenkling, the Derodontidæ, Lymexylonidæ, and Micromalthidæ; and part 65, by S. Schenkling, the Oedemeridæ.

White grubs in Iowa, R. L. WEBSTER (*Iowa Sta. Circ. 29 (1916), pp. 4, figs. 3*).—This circular calls attention to the importance of white grubs in Iowa and discusses control measures.

An insect pest of lucern, C. FRENCH, JR. (*Jour. Dept. Agr. Victoria, 13 (1915), No. 9, pp. 567–569. figs. 3*).—The cockchafer *Heteronyx piceus* has been found to be a source of injury to alfalfa at Werribee, Victoria, considerable loss resulting.

Bud weevils and other bud-feeding insects of Washington, M. A. YOTHERS (*Washington Sta. Bul. 124 (1916), pp. 5–43, pls. 6, figs. 3*).—This paper reports observations made of the biology and control of weevils and other beetles which have been injuring the fruit buds of one- and two-year-old fruit trees in Washington State. It appears that several of the weevils are native feeders on the

sagebrush (*Artemisia tridentata*), the principal host plant in the districts where they are found, the injury being brought about through the clearing up of such lands and setting them to fruit trees, which then become the only available food plant.

The injury caused by the various species is said to have been considerable; at times every bud is eaten out and the trees die or do not get a start after they are planted. At other times only a few of the buds are destroyed and the trees are able to maintain themselves. In some orchards it was found that as many as half of the young trees were killed. Although this was an unusually high percentage, it is not uncommon to find new plantings with losses of 20 per cent.

The studies in 1911 were made at four localities and during 1912 at as many as 15. A list is given of 14 weevils and 5 other beetles studied, together with tables showing the different plants upon which the various species occur, the remedies tried, and the results obtained.

In regard to methods of control it is stated that as the weevils are wingless and can not fly they can be prevented from destroying the buds by the use of paper-cone tree protectors, here described, which are the most effective and practical means of protecting the trees against the weevils. The paper cones are also effective against climbing cutworms. With a little care and attention to the adjustment of the cones they will give protection throughout the first season, which is usually as long as necessary, as the weevils do not often injure older trees.

The weevils noted are *Cercopeus artemisiæ, Cleonus lobigerinus, C. quadrilineatus, Geoderces melanothrix, Melamomphus luteus, M. nigrescens, Mimetes setulosus, Mylacus saccatus, Panscopus æqualis, P. sulcirostris, Sitona apacheana, Tosastes cinerascens, Tricolepsis* sp., and *Tychius lineellus.* The other beetles noted are *Cotalpa granicollis, Eusattus muricatus, Glyptoscelis alternata, Polyphylla decemlineata,* and *Syneta albida.*

From an economic standpoint *T. cinerascens* is the most important of the weevils discussed in this paper, being the cause of thousands of dollars of losses to orchardists throughout the whole of the arid region in the State. *M. setulosus*, the most abundant weevil, is the second most injurious of the bud weevils here discussed, having a wider distribution and a larger number of host plants than any of the other species. *E. muricatus* has been observed to travel readily up the trees and from bud to bud and can soon destroy all the buds on a tree. On older trees it feeds on the blossoms as well as the buds and young leaves and has been known to destroy the blossoms in some orchards to such an extent as practically to ruin the crop.

The strawberry weevil (Anthonomus signatus), T. J. Headlee (*New Jersey Stas. Circ. 56 (1916), pp. 3–8, fig. 1*).—Measures hitherto recommended for the control of the strawberry weevil having proved unsatisfactory, except in a limited way, the author was led to conduct the insecticide experiments here briefly reported, assisted by E. Douglass. While they were conducted in only one field with but a single variety of strawberry (Heritage), the results indicate what may be accomplished.

It was found that combinations of arsenate of lead and sulphur maintained as a dust coating throughout the two weeks when the strawberry is subjected to the serious attack will afford almost perfect protection. While the half-and-half mixture of lead and sulphur is the most efficient, a mixture composed of one part of arsenate of lead to five parts of sulphur is effective and much cheaper. Two applications were in this case sufficient, the first being applied just as the beetles began to damage the buds and the second as soon there-

after as the first treatment had disappeared from the upper surface of the foliage. The mixtures are readily applied with a powder gun and should coat thoroughly all parts of the plants, especially the buds. For the 1:5 mixture the cost should not exceed $8 and for the 1:1, $16 an acre, and in practical work this charge will probably prove to be materially less.

Some injurious Indian weevils (Curculionidæ), G. A. K. MARSHALL (*Bul. Ent. Research, 5 (1915), No. 4, pp. 377–380, figs. 4; 6 (1916), No. 4, pp. 365–373, figs. 5*).—The species described in the first paper as new to science are *Phytoscaphus dissimilis*, found feeding on young tea shoots, and *Corigetus bidentulus*, a serious pest of tea, in Assam; and *Rhynchænus* (*Orchestes*) *mangiferæ*, the larvæ of which bore in the leaves of the mango tree, and *Pachytychius mungonis*, a cowpea (*Phaseolus mungo*) pest, in Madras.

The new species described in the second part are *Emperorrhinus defoliator* n. g. and n. sp., found to defoliate the alder tree (*Alnus nitida*) and fruit trees; *Coniatus indicus* n. sp., which attacks tamarisk (*Tamarix indica*); *Ceuthorrhynchus portulacæ* n. sp., the larvæ of which mine the leaves of purslane (*Portulaca oleracea*) cultivated as a vegetable; *Baris portulacæ* n. sp., found boring in the stems of purslane; *Athesapeuta oryzæ* n. sp., a serious pest of rice; and *Acythopeus citrulli* n. sp., a pest of watermelons.

[Mouth parts of the honeybee], E. R. ROOT (*Jour. Heredity, 7 (1916), No. 1, pp. 46, 47, fig. 1*).—Examinations of a colony of bees that worked in red clover in full bloom showed that the tongues of this particular colony measured 0.23 and 0.24 in., whereas the tongues of normal bees measured only 0.16 and 0.17 in.

Natural swarming of bees and how to prevent it, M. PETTIT (*Ontario Dept. Agr. Bul. 233 (1915), pp. 15, figs. 8*).—Practical information for the beekeeper.

A monograph of the Formicidæ of South Africa (Ponerinæ, Dorylinæ), G. ARNOLD (*Ann. So. African Mus., 14 (1915), pt. 1, pp. 159, pl. 1, figs. 8*).—Two of the five subfamilies of Formicidæ are here dealt with.

It is pointed out that in South Africa the Ponerinæ comprise about 20 per cent of the known ant fauna, and that since at least 80 per cent of their food consists of termites they constitute one of the chief checks to these pests in the Tropics. It is thought probable that all, or at least the majority, of the species of the subfamily Dorylinæ are carnivorous, although one species (*Dorylus orientalis*) has been shown to feed also upon tubers and the bark of trees. Another species (*D. fulvus rhodesiæ*) has apparently been found to attend membracid larvæ feeding on the roots of maize.

The acrobat ant, H. A. BALLOU (*Agr. News [Barbados], 14 (1915), No. 351, p. 330*).—An account of *Cremastogaster* sp., which is abundant in different parts of Grenada and may become troublesome in cacao fields in that island.

The control of ants which take away onion seed (*Agr. News [Barbados], 14 (1915), No. 354, p. 378*).—A brief report of experiments conducted with a view to preventing ants from removing onion seeds when planted and from biting holes in the young shoots, as occurs in St. Vincent. In experiments conducted the most satisfactory results were obtained through attracting the ants to various baits and then killing them.

Two new species of Arrhenophagus with remarks, A. A. GIRAULT (*Jour. N. Y. Ent. Soc., 23 (1915), No. 4, pp. 241, 242*).

Notes on two South American parasitic Hymenoptera, A. A. GIRAULT (*Entomologist, 48 (1915), No. 628, pp. 213, 214*).—*Baeus auraticeps* n. sp. is recorded as having been reared in numbers from the egg sac of a spider at Anna Regina, British Guiana.

Three new British chalcidoid Hymenoptera, with notes, A. A. GIRAULT (*Entomologist, 48 (1915), No. 628, pp. 217, 218*).—*Aphidencyrtus aspidioti brit-*

tanicus n. sp. and *Apterotrix longiclava* n. sp. were reared from the oyster shell scale at Manchester, England.

Ticks of the Belgian Kongo and the diseases they convey, G. H. F. NUTTALL and C. WARBURTON (*Bul. Ent. Research, 6 (1916), No. 4, pp. 313–352, figs. 48*).—This paper, prepared at the request of the Belgian authorities, includes a brief résumé of the classification of ticks, with a short illustrated account of the species occurring in the Kongo, discussions of the general biology of ticks and the special biology of those occurring in the Kongo and their relation to disease, instructions for rearing ticks, etc.

The life cycle of Trypanosoma brucei in the rat and in rat plasma, R. ERDMANN (*Proc. Nat. Acad. Sci., 1 (1915), No. 10, pp. 504–512, figs. 7*).—The author's investigations have resulted in the discovery of dimorphic forms, latent or round forms, and crithidia-like forms in *T. brucei* outside of the invertebrate host.

FOODS—HUMAN NUTRITION.

A sanitary study of condensed milk, W. H. PARK, M. C. SCHROEDER, and P. BARTHOLOW (*N. Y. Med. Jour., 102 (1915), No. 22, pp. 1073–1083, figs. 10*).—The investigation herein reported concerns the bacterial content of the milk used in preparing condensed milk; the process used in condensing milk with reference to its effect on the bacteria; and a bacteriological and chemical examination of the finished product.

Evaporated milk contained fewer bacteria than condensed milk, probably owing to the higher temperature used in its manufacture. Sweetened condensed milk showed the following variations in composition: Cane sugar, from 33.15 to 49.85 per cent; milk sugar, 7.57 to 15.34 per cent; and protein, 6.73 to 13.59 per cent.

The data of the experiments and clinical observations are summarized in part as follows:

"The value of sweetened condensed milk depends upon the care and cleanliness used in manufacture.

"There is a want of evidence that the bacteria or chemical constituents are capable of affecting the health. Only the use of the best quality of sweetened condensed milk is to be commended in the feeding of infants.

"Sweetened condensed milk, when carefully prepared from whole milk, has special indications as an infant food. They may be thus expressed: Many infants are unable to digest the fat of cow's milk, even when two or three volumes of water are added. In such cases the half digested curds of casein are vomited. The change in these circumstances to sweetened condensed milk allays the vomiting. These facts are well established clinically.

"Sweetened condensed milk has generally a constipating effect."

The opposite view that it produces diarrhea seems to be wanting in evidence.

"Clinical evidence . . . [indicates] that the intestinal irritation caused by milk is an effect of the action of the liquid portion, when freed of fat, sugar, and protein."

The water content of meat products, E. FEDER (*Chem. Ztg., 40 (1916), No. 21, pp. 157–160*).—A controversial article (E. S. R., 34, p. 365).

Annual report of the Commissioner of Fisheries to the Secretary of Commerce for the fiscal year ended June 30, 1915, H. M. SMITH (*U. S. Dept. Com., Bur. Fisheries Doc. 827 (1915), pp. 83*).—This report contains general information and data regarding the quantities and values of food fish products landed at various places.

Ptomaine poisoning from "creamed" codfish, M. A. Blankenhorn, G. E. Harmon, and P. J. Hanzlik (*Cleveland Med. Jour., 15 (1916), No. 2, pp. 97–104; abs. in Jour. Amer. Med. Assoc., 66 (1916), No. 15, p. 1166*).—A number of cases of so-called ptomaine poisoning, attributed to the eating of creamed salted codfish, are reported.

Bacteriological examination of the creamed fish showed the presence of *Bacillus coli communis* and other saprophytes and some staphylococci, but the authors do not attribute the symptoms to infection by the organisms in the fish material. The same physiological reactions were given by extracts of the creamed fish and of the same brand of salted codfish which was allowed to putrefy and was then prepared in the same manner as the food which the patients had been eating. The purified active extract of the creamed putrefied codfish contained a physiologically active base, whose chemical reactions resembled those of the group of diamins to which putrescin, cadaverin, and histamin belong.

Suitability of different kinds of wheat for bread making, O. Rammstedt (*Ztschr. Öffentl. Chem., 21 (1915), Nos. 20, pp. 306–312; 21, pp. 321–329; 22, pp. 337–345*).—Analytical data and baking tests are herein reported from which the author concludes in part as follows:

Small amounts of albumin and globulin are necessary in flour to give good results in baking, but too much or too little of these constituents acts unfavorably. The ratio of gliadin to glutenin influences the volume of the loaf, and the higher the total phosphoric acid content the greater the loaf volume. The water-soluble extractives also determine baking quality, and there seems to be a relationship between the carbohydrates soluble in water and the volume of the loaf.

A modified war bread, Rossmann (*Chem. Ztg., 40 (1916), No. 18, p. 135*).—The composition of this substance (called N-bread) is as follows: Water 44.31, ash 1.31, fat 0.2, crude fiber 0.03, protein 5.87, and nitrogen-free extract 48.28 per cent. The bread is made by mixing 217 gm. of rye or wheat flour with 56 gm. of potato flour and adding to this 200 cc. of water containing 7 gm. of nutritive yeast, 8 gm. of table salt, and from 4 to 5 gm. of yeast as a rising agent. The product contains more protein than previously noted war breads and is recommended by the author for general use even after the war.

Fruit preservation and inspection, T. Zschokke (*Landw. Jahrb. Schweiz, 29 (1915), No. 5, pp. 588–590*).—As a part of the report on fruit investigations are included the results of experiments on preserving plums and cucumbers, fruit inspection, the testing of fruit kilns, etc.

Factors which influence the quality of tea, J. J. B. Deuss (*Dept. Landb. Nijv. en Handel [Dutch East Indies], Meded. Proefstat. Thee, No. 42 (1915), pp. 26, pl. 1*).—This bulletin contains data regarding the judgment of tea, such factors as the caffein content, the ash content, the quantities of essential oils, and the amount of stems present in the tea being considered. Some of the material has been noted from another source (E. S. R., 34, p. 166).

The dairy and pure food laws of the State of Connecticut (*[Hartford, Conn.]: Off. Dairy and Food Comr., [1916], pp. 52*).—The text of the laws is given as amended to the close of the legislative session of 1915.

Twenty-second annual report of the dairy and food commissioner of the State of Michigan for the year ending June 30, 1915, J. W. Helme (*Ann. Rpt. Dairy and Food Comr. Mich., 22 (1915), pp. 405, pls. 11*).—The various activities of the department during the year ended July 1, 1915, are recorded.

The report of the state analyst, F. L. Shannon, contains the results of the examination of 2,195 samples of miscellaneous foods and beverages, of which

445 were found to be adulterated, misbranded, or illegally sold, and also the analysis of 278 samples of feeding stuffs. The report of the drug analyst, A. R. Todd, presents the results of the examination of 558 samples of drugs, of which 134 were found to be adulterated. The work of the division of weights and measures is reported in detail. The publication also contains general information relating to pure-food topics and gives results of the inspection of dairies, creameries, cheese factories, city-milk depots, etc. A statement of prosecutions made during the fiscal year, the results of court proceedings brought, and reprints of the state food and drug laws and court decisions relative thereto are included.

Fifteenth biennial report of the Minnesota State Dairy and Food Commissioner, J. G. Winkjer (*Bien. Rpt. Minn. State Dairy and Food Comr., 15 (1913–14), pp. 89, figs. 10*).—The work of the commission for the biennial period ended July 31, 1914, is reviewed. The report of the state chemist, J. Hortvet, gives the results of the analysis of 4,181 samples of miscellaneous foods, beverages, paints, oils, etc., of which 1,885 were found to be illegal.

The lunch room, P. Richards (*Chicago: The Hotel Monthly, 1916, 2. ed., rev. and enl., pp. 239, pl. 1, figs. 117*).—This publication contains information on plans, equipment, management, accounting, food and drink sales, and bills of fare, and gives recipes.

Feeding of prisoners of war in Germany, Friedrich (*Jour. Roy. Army Med. Corps, 24 (1915), No. 4, pp. 387–394*).—This article is a translation of an official German order for feeding prisoners of war. Classified information is given regarding the management of camps and the regulation of supplies, including standardized menus for feeding the men.

The biochemical analysis of nutrition, C. L. Alsberg (*Jour. Wash. Acad. Sci., 6 (1916), No. 10, pp. 269–280*).—This lecture discusses some of the recent contributions to the knowledge of the component parts of the food elements and their fate in metabolism, especially the investigations of the rôle of the amino acids in nutrition.

Experiments on the effects of a limited diet, VII–IX, S. Baglioni (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 11, pp. 1158–1163; II, Nos. 4, pp. 213–220; 5, pp. 254–259*).—Three papers are included, continuing previous work (E. S. R., 31, p. 264).

Reporting studies of the comparative nutritive value of wheat flour, corn flour, and egg powder, feeding experiments with laboratory animals (white rats) are described, in which a standard basal ration was supplemented in turn by egg powder, wheat flour, and corn flour. The rats receiving egg powder exhibited a marked increase in body weight, while those receiving wheat or corn flour failed to show similar development.

The author concludes that the nutritive value of the protein in corn and wheat is inferior to that of the protein in egg powder. It is noted, however, that the nutritive value of zein or gliadin alone is less than that of the whole grain protein.

In studies of the modifications of the metabolism of guinea-pigs by exclusive feeding of corn, wheat, or green plants, feeding experiments with guinea pigs which received an exclusive diet of these substances, with the addition of water, are reported. In most cases the animals died, though some survived on the ration of green plants and water. The results indicate, in the author's opinion, that the animals died of acidosis produced by a lack of basic salts in the ration.

The rectal and intravenous utilization of grape sugar, G. Bergmark (*Skand. Arch. Physiol., 32 (1915), No. 4–6, pp. 355–404, figs. 36*).—Experimental

data are reported which show that dextrose may be utilized either by rectal or intravenous injection. The excretion of acetone bodies was in some cases appreciably diminished by this treatment.

The rectal and intravenous utilization of grape sugar, F. REACH (*Skand. Arch. Physiol., 33 (1915), No. 1–3, pp. 81–84, fig. 1*).—A comment on the above reference.

The limit of assimilation of glucose, A. E. TAYLOR and FLORENCE HULTON (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 173–175*).—The authors report feeding experiments with normal men who received varying amounts of glucose (from 200 to 500 gm.) from 2½ to 3 hours after a light breakfast. Analyses of the blood and urine were made to indicate the extent of the utilization.

"Apparently there is in the majority of healthy adult males no limit of assimilation of glucose; glucosuria does not occur following the largest possible ingestions of pure glucose."

The influence of salicylate on metabolism in man, W. DENIS and J. H. MEANS (*Jour. Pharmacol. and Expt. Ther., 8 (1916), No. 6, pp. 273–283*).—Experimental data are reported concerning the nitrogenous and respiratory metabolism of normal men as affected by the ingestion of sodium salicylate. The results indicate an increased excretion of nitrogen, phosphates, and uric acid, but no change in the respiratory quotient.

Beri-beri in Lebong.—An account of the steps taken to eradicate the disease during 1914, J. C. KENNEDY (*Jour. Roy. Army Med. Corps, 25 (1915), No. 3, pp. 268–285, figs. 2*).—A clincal report of an epidemic among English soldiers, which proved to be beri-beri. The disease was eradicated by providing an adequate diet and by improving the general health of the soldiers by means of hygienic surroundings and physical exercise.

Clinical calorimetry, VI–XVII (*Arch. Int. Med., 15 (1915), No. 5, pp. 882–944, figs. 9; 17 (1916), No. 6, pp. 855–1059, figs. 18*).—A continuation of previous work (E. S. R., 34, p. 68).

VI. *Notes on the absorption of fat and protein in typhoid fever,* W. Coleman and F. C. Gephart (pp. 882–886).—Analytical data are reported showing the metabolism of protein and fat for seven typhoid patients on the high-calorie diet.

VII. *Calorimetric observations on the metabolism of typhoid patients with and without food,* W. Coleman and E. F. Dubois (pp. 887–938).—The calorimetric data herein reported were obtained by the use of the respiration calorimeter in Bellevue Hospital.

VIII. *On the diabetic respiratory quotient,* G. Lusk (pp. 939–944).—The information presented in this paper is of value in explaining metabolism in diabetes. Particular weight is attached to the relationship between the ingestion of protein and the respiratory quotient. Both normal and diabetic respiratory quotients are given for the individual amino acids.

IX. *Further measurements of the surface area of adults and children,* Margaret Sawyer, R. H. Stone, and E. F. Dubois (pp. 855–862).—Measurements of surface are reported, the results of which are summarized as follows:

"The so-called 'linear formula' [E. S. R., 34, p. 68] for the estimation of the surface area has been satisfactorily tested on four new subjects of varying size and shape. In addition partial measurements of two legless men have been made. The average error in the formula when applied to the four subjects was 1.3 per cent. Two of the subjects were children and in these cases the error in the formula was under 3 per cent. Since the youngest was about two years old, it does not seem advisable to use the formula for babies under this age until the factors have been tested by the measurements of infants."

X. *A formula to estimate the approximate surface area if height and weight be known*, D. and E. F. Dubois (pp. 863–871).—"The method of calculating the surface area from the so-called 'linear formula' is given with a slight correction in the factor for the arms and an alternative measurement for the thighs. A simpler 'height-weight formula' has been devised to estimate the surface of subjects if only their height and weight be known. This is expressed in the terms $A=W^{0.425}\times H^{0.725}\times C$, A being the surface area in square centimeters, H the height in centimeters, W the weight in kilograms, and C the constant 71.84. A chart has been plotted from this formula so that the approximate surface area may be determined at a glance."

"The errors in the various formulas [are estimated] as follows: 'linear formula' and 'height-weight formula' maximum $\pm$ 5 per cent, average $\pm$ 1.5 per cent, Meeh's formula [$A=W^{2/3}\times C$], maximum + 30 per cent, average + 15 per cent. In general the maximum figures apply only to those of unusual shape, while with those of average body form the average error will seldom be exceeded."

XI. *A comparison of the metabolism of men flat in bed and sitting in a steamer chair*, G. F. Soderstrom, A. L. Meyer, and E. F. Dubois (pp. 872–886).—Experimental data are summarized by the authors as follows:

"The Sage calorimeter in the season of 1914–15 was fully as accurate as in the previous years. Alcohol checks gave the following total errors: Heat + 0.51 per cent, oxygen — 0.51 per cent, carbon dioxid — 0.36 per cent, water + 3.13 per cent. The respiratory quotient averaged 0.666, while the theoretical quotient was 0.6667.

"Four normal men and two cardiac patients were studied in the calorimeter lying flat in bed and in the semireclining position propped up with a back rest, or else in a comfortable steamer chair. A total of 21 experiments showed that the metabolism averaged 3 per cent lower in the semireclining posture. One of the cardiacs, and possibly one of the normal controls, showed a slightly higher metabolism when propped up in bed.

"The difference between the results is so small that in the study of pathologic cases . . . the same figures [can be used] for the average normal metabolism in both postures. In the majority of cases, however, the energy requirement is lower in the orthopneic position."

XII. *The metabolism of boys 12 and 13 years old compared with the metabolism at other ages*, E. F. Dubois (pp. 887–901).—"Eight normal boys, 12 or 13 years old, were studied in the respiration calorimeter four to six hours after a small breakfast. They were allowed to read for one of the two experimental hours, but were very quiet. The methods of direct and indirect calorimetry agreed within 0.04 per cent. Their heat production per unit of surface area was 32 per cent higher than the adult level according to Meeh's formula, or 25 per cent higher according to the more accurate 'linear formula.'

"In studying the effect of growth on metabolism, interpretation of the results obtained on infants is complicated by the fact that babies differ greatly from adults in the proportions of the body and the relative size of the viscera, notably the liver and thyroid. Boys just before the onset of puberty have almost adult proportions. They are in the midst of a period of accelerated growth. The fact that the metabolism is high points to a specific increase in the metabolism of the growing organism."

XIII. *The basal metabolism of normal adults with special reference to surface area*, F. C. Gephart and E. F. Dubois (pp. 902–914).—"The basal metabolism of four normal men and one woman has been determined, and experiments have been made on the specific action of protein and glucose.

"A study of the new controls, together with those reported in the literature since . . . [the] last publication [E. S. R., 34, p. 68], supports the views previously expressed. There is no reason to change the statement made in . . . [the] previous paper, that if a given subject's basal metabolism is more than 10 per cent from the average, it may be regarded as abnormal, but can not be proved abnormal unless the departure from the average is at least 15 per cent. The average basal metabolism of normal men is 34.7 calories per square meter per hour as determined by Meeh's formula. On account of the average plus error of about 15 per cent in Meeh's formula the average figure is 39.7 calories, or in round numbers 40 calories, when the more exact 'linear formula' or the new 'height-weight formula' is used to determine surface area.

"The average metabolism of fat and thin subjects is the same according to surface area when the surface area is correctly measured. The metabolism of women averages 37 calories, or 6.8 per cent lower than that of men. A group of men and women between the ages of 40 and 50 gave figures 4.3 per cent below, and a group 50 to 60 years old 11.3 per cent below the average for the larger group between the ages of 20 and 50.

"Under the atmospheric conditions of the calorimeter experiments the average water elimination by normal men through skin and lungs is 28.4 gm. an hour. About 24 per cent of the heat produced is dissipated in the vaporization of water.

"The figures for the specific dynamic action of protein and glucose previously obtained are confirmed. A table of normal standards is given."

XIV. *Metabolism in exophthalmic goiter*, E. F. Dubois (pp. 915–964).—By means of the respiration calorimeter, 37 observations were made on 11 patients suffering from exophthalmic goiter.

XV. *The basal metabolism in pernicious anemia*, A. L. Meyer and E. F. Dubois (pp. 965–979).—A report of calorimetric observations of basal metabolism in six cases of anemia.

XVI. *The basal metabolism of patients with cardiac and renal disease*, F. W. Peabody, A. L. Meyer, and E. F. Dubois (pp. 980–1009).—Clinical observations and calorimeter experiments are reported.

XVII. *Metabolism and treatment in diabetes*, F. M. Allen and E. F. Dubois (pp. 1010–1059).—The data of clinical observations and respiration calorimeter experiments during the treatment of six cases of diabetes are reported in detail.

The basal energy requirement of man, E. F. Dubois (*Jour. Wash. Acad. Sci., 6 (1916), No. 11, pp. 347–357, fig. 1*).—In this lecture the author considers the definition of the term basal energy requirement, the manner in which metabolism is studied, and the factors by which it is influenced in health and disease. Although muscular work affects metabolism to a greater extent than all other factors combined, attention is called to the very important part that diet plays in such diseases as typhoid fever, exophthalmic goiter, and diabetes.

ANIMAL PRODUCTION.

Vigor and heredity, J. L. Bonhote (*London: West, Newman & Co., 1915, pp. XII+263, pls. 11, figs. 4*).—This book treats of the inadequacy of present theories of heredity, prepotency, inbreeding, coloration as an index of vigor, and other related subjects.

The formation of protein in the animal body from the nonprotein substances, A. Stutzer (*Fühling's Landw. Ztg., 64 (1915), No. 11–12, pp. 281–*

295).—The author summarizes the results of previous investigators in feeding ammonium salts, urea, asparagin, and other protein-rich substances, to carnivora, herbivora, and omnivora.

A list of cited literature is included.

Studies in the blood relationship of animals as displayed in the compositions of the serum proteins.—V, The percentage of nonproteins in the sera of certain animals and birds, R. M. Jewett (*Jour. Biol. Chem., 25* (*1916*), *No. 1, pp. 21, 22*).—In former articles of this series (E. S. R., 32, p. 861) it was assumed that the amount of nonproteins in the blood sera of all animals was about the same, but it has since been ascertained that this assumption is not accurate. The present work was undertaken to ascertain the amount of nonprotein in the blood of each kind of animal formerly studied and to correct the figures which are affected by the revised estimation of the nonproteins.

A table is given showing the refractive indexes obtained, the percentages of albumin, globulin, and total protein determined by previous investigators, and the figures as corrected by the present investigation, for the horse, ox, rat, hog, sheep, goat, cat, dog, guinea pig, hen, and duck.

The valuation of feeding stuffs, E. Laur (*Fühling's Landw. Ztg., 64* (*1915*), *No. 15–16, pp. 377–407; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 12, pp. 1694–1697*).—On the basis of the researches of Pfeiffer, Neubauer, and Mach on the estimation of the cash value of feeding stuffs, the German Federation of Agricultural Experiment Stations adopted in September, 1913, certain resolutions. The author subjects all these conclusions to criticism and endeavors to establish the principles for a just valuation of feeding stuffs.

Comparative feeding value of green grass and hay (*Mark Lane Express, 114* (*1915*), *No. 4375, p. 145*).—Experiments were conducted on the comparative feeding value of fresh grass and hay, the latter made in the ordinary way and also dried in hot-air chambers.

The effect of these fodders on milk yield was tested with three ewes and a goat, and the digestibility with the same three ewes later in the summer. The milk yield showed no constant difference in quantity or in composition between the green and dried grass, but the digestibility of fresh grass was constantly, though slightly, greater.

It is pointed out that the process of drying has a distinct influence on the nutritive value. In ordinary haymaking there is considerable loss from oxidation. This may be avoided by a rapid drying in which the initial temperature is high but does not exceed 100° C. The changes in digestibility seem to be due rather to changes of a physical nature than to chemical decomposition. They are sometimes so small as hardly to alter the proportion of starch.

The feeding of grain sorghums to live stock, G. A. Scott (*U. S. Dept. Agr., Farmers' Bul. 724* (*1916*), *pp. 14, figs. 5*).—This treats of the composition and feeding value of the various grain sorghums, including analyses, and data as to methods of feeding and the value of the sorghums as forage, together with a number of suggested rations for various kinds of live stock.

In tests conducted by the Department on Texas farms grain sorghums were fed to beef cattle. The results obtained indicate the efficiency of the grain-sorghum feeds in the form of chop, head chop, silage, fodder, or stover, both in wintering cattle and in finishing them for the block. Silage of the grain sorghums was found to be very beneficial for increasing the appetites of feeders, keeping them in fine condition, and adding a high finish.

The following table summarizes the results of the work:

Results of use of grain sorghums in feeding tests on Texas farms.

Age of cattle.	Number fed.	Period of feeding.	Daily ration per head on full feed.	Average daily gain per head.
				Pounds.
2 years	127	Oct. 28 to Feb. 2	Cotton-seed meal;[a] Kafir-corn chops;[a] silage.	2.39
3 years	200	Jan. 1 to May 1	Sorghum fodder;[a] cotton-seed meal, 6 pounds; Kafir-corn chops, 8 pounds; silage 40 pounds.	1.84
3 years	32		Cotton-seed meal, 4 pounds; milo-maize chops, 18 pounds; silage, 40 pounds; sorghum butts.[b]	1.75
3 years	68	Jan. 17 to July 3	Cotton-seed meal, 6 pounds; silage, 60 pounds; bundled Kafir corn, 6 pounds.	1.75
20 months	90	Nov. 1 to Feb. 12	Cotton-seed meal, 4.5 pounds; silage, 30 pounds; wheat straw.[b]	2.08
Steer calves		Dec. 1 to April 16	Cotton-seed meal, 3 pounds; Kafir-corn chops, 5 pounds; silage, 20 pounds; straw.[b]	1.76
Do	63	Oct. 31 to June 4	Cotton-seed meal, 2.5 pounds; milo-maize chops, 10 pounds; silage 20 pounds; wheat straw.[b]	1.65
Heifer calves	116	Oct. 31 to May 1	Cotton-seed meal, 2 pounds; milo-maize chops, 5 pounds; silage, 25 pounds; wheat straw.[b]	1.38
Do	126	Winter	Cotton-seed meal, 1.5 pounds; milo-maize chops, 5 pounds; silage, 25 pounds; straw.[b]	1.38
Calves		December-March, wintered only.	Cotton-seed meal,[a] silage;[a] straw.[b]	1.42

[a]Amounts not given. [b]Were given all they would eat.

The influence of the lactic acid bacteria on protein, A. Stutzer (*Biochem. Ztschr., 70 (1915), No. 3–4, pp. 299–305*).—It has been found that the best fermentation in silos is obtained by using lactic acid bacteria, preferably those growing at a low temperature, as *Bacillus cucumeris fermentati.* In tests made by the author hay was subjected, with and without the addition of sugar, to the action of these bacteria, but the experiment showed that these bacteria are incapable of decomposing the protein present in hay. Experiments conducted to determine whether *B. cucumeris fermentati* has the power of forming protein synthetically by means of asparagin, urea, or ammonium acetate indicated that this is not possible.

The feeding value of apple pomace, J. B. Lindsey (*Massachusetts Sta. Circ. 58 (1915), pp. 4*).—A revision of Circular 47, previously noted (E. S. R., 32, p. 363).

Beet residues for farm stock, J. B. Lindsey (*Massachusetts Sta. Circ. 62 (1916), pp. 7*).—A revision of Circular 48, previously noted (E. S. R., 33, p. 267).

Analysis of feeding stuffs, B. E. Curry and T. O. Smith (*New Hampshire Sta. Bul. 178 (1916), pp. 16*).—Analyses are given of the following feeding stuffs: Wheat bran, wheat middlings, shredded wheat waste, red dog flour, rye middlings, cotton-seed meal, hominy feed, hominy meal, alfalfa meal, dried beet pulp, brewers' dried grains, distillers' dried grains, cracked bone, bone

meal, meat scrap, fish scrap, gluten feed, linseed oil meal, provender, oat hulls, and various mixed and proprietary feeds.

Analyses of commercial feeding stuffs, P. H. Wessels and F. O. Fitts (*Rhode Island Sta. Insp. Bul., 1916, May, pp. 12*).—Analyses are given of the following feeding stuffs: Fish scrap, meat scrap, cotton-seed meal, linseed meal, gluten feed, dried brewers' and distillers' grains, wheat middlings, bran, provender, hominy feed, ground oats, sugar-beet meal, oat hulls, dried beet pulp, and alfalfa meal, and various proprietary and mixed feeds.

Stock raising (*U. S. Dept. Int., Rpt. Comr. Indian Aff., 1915, pp. 28, 29*).—A general account of the status of stock raising on the various Indian reservations. It is stated that Indian stock has been so successfully managed since the policy of increasing stock raising among the Indians was inaugurated some two years ago as to justify the undertaking fully. Inspections and reports show the tribal herds and individually owned cattle, horses, and sheep to be rapidly improving in breed, increasing in number, and showing a gratifying profit on the investment. It is predicted that the Indian-owned stock will soon become a substantial factor in the world's supply.

Cattle-feeding experiment, 1914–15, W. Bruce (*Edinb. and East of Scot. Col. Agr. Rpt. Leaflet, Ser. C, No. 1 (1915), pp. 4*).—In cattle-feeding experiments comparing the value of various rations (palm-nut cake, dried distillers' grains, chaffed hay and Bombay cotton cake, and Bombay cotton cake) the dried distillers' grains proved a cheaper feeding stuff than Bombay cotton cake. The results indicate that palm-nut cake (palm-kernel cake) is a useful feeding stuff and that apparently it is practically equal in value to the best class of dried distillers' grains, which it somewhat resembles in composition. It is stated that cattle do not eat this cake when it is first put before them, but that in a few days they take it quite readily, and that there appears to be no practical difficulty in feeding it to fattening steers when they are accustomed to it from the beginning of the fattening period.

Report on cattle-feeding experiments conducted at Crichton Farm, Dumfries, 1911–1915, W. G. R. Paterson (*West of Scot. Agr. Col. Bul. 67 (1915), pp. 42, pl. 1*).—In three series of cattle-feeding experiments, comparing the value of decorticated and undecorticated cotton cakes, soy-bean cake, and linseed cake, decorticated cotton cake and soy-bean cake each proved superior to a mixture of linseed cake and undecorticated cotton cake, even when 1 lb. additional of the mixture was fed. The difference between decorticated cotton cake and soy-bean cake was not very great but the balance was in favor of the former. The return for every ton of oats, hay, straw, and turnips was very much greater when fed with decorticated cotton cake than when fed with a mixture of linseed cake and undecorticated cotton cake.

Palm-nut cake proved to be inferior to a mixture of decorticated cotton cake and crushed oats.

"Bulldog" cattle (*Jour. Heredity, 7 (1916), No. 6, pp. 263–265, figs. 2*).—An account of the Niata breed of cattle, described by Darwin. This breed is supposed to have arisen among the Indians of South America, but is now becoming extinct. The extraordinary jaw and face are thought to be due to mutation.

Mathematical selection of Swiss cattle (*Breeder's Gaz., 69 (1916), No. 18, p. 958, figs. 3*).—A method of appraising cattle by means of a rational mathematical system has recently been adopted by the Swiss Government. The purpose of the method is to determine and express in decimals the correlations which exist between the conformation of the different parts of the body of the animal and its fitness. The instrument deemed most practical for this is the

measuring cane invented by A. Deriaz of Lausanne. This is composed of a simple rod, grooved and graduated, and provided with two perpendicular arms, one of which is fixed permanently at one end and the other can slide along the rod and be stopped at any desired point.

The measurements taken on the animal with this instrument are as follows: (1) Measurements of the length of the body, chest, loins, and quarters; (2) measurements of the height at the withers (from the ground to the highest point on the animal), of the knee (from the ground to the lower edge of the joint), of the loin, and of the tail-head; (3) measurements of the width, by means of the two arms of the instrument, of the hooks, pin bones, and thighs; and (4) measurements of the head, principally its length, its width between the base of the horns, and the width of face.

The Yunnan breed of sheep, A. Hallot (*Bul. Écon. Indochine, n. ser., 18 (1915), No. 112, pp. 165–181; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 11, pp. 1512–1514*).—An account of the breed characteristics and utility value of the sheep of Yunnan, China.

The fleece is white, black or white with spots of fawn, red, or black. With the exception of a tuft of long hair hanging over the forehead, the fleece extends from the base of the neck to the knees and above the hocks. No wool occurs on the belly, but hair often occurs under the chest, extending toward the withers. With certain rare exceptions the wool is mixed with kemp in variable quantity. In the tallest animals the base of the fleece consists of long stiff hairs.

The wool fiber and certain phases of scouring and loose wool dyeing, L. J. Mátos (*Bul. Nat. Assoc. Wool Manfrs. 45 (1915), No. 2, pp. 146–171, figs. 10*).—Methods of scouring and dyeing wool are described.

Fattening lambs, J. M. Jones (*Texas Sta. Bul. 186 (1916), pp. 3–15, figs. 4*).—Two lots of about 250 47-lb. range-bred lambs were fed 119 days as follows: Lot 1, cotton-seed meal, cotton-seed hulls, and feterita and sorghum silage; lot 2, cotton-seed meal and feterita and sorghum silage. After 59 days of the test feterita and milo-maize chops were added to the ration of lot 2; and after 102 days the ration of lot 1 was supplemented by the same concentrate.

The results indicate that good silage can be fed to fattening lambs without injury to them. During the first 59 days the lambs in lot 2 consumed an average of 3.78 lbs. of silage per head daily and their average daily gain was 0.285 lb. per head.

"While silage seems to have a place in the ration of a fattening sheep it should not constitute the only roughage. Owing to the succulent nature of silage, it is quite impossible for lambs to consume enough of this feed to get the necessary amount of dry matter that is required by the animal body. Lambs receiving silage as the sole roughage are inclined to go 'off feed.' The lambs in lot 1 received cotton-seed hulls in addition to the silage, and throughout the entire feeding period all the lambs remained continually 'on feed.' No moldy silage was fed to the lambs and no losses directly attributed to the feeding of inferior silage resulted."

The lambs in lot 1 made a good economical gain during the early part of the feeding period, but after about 100 days they apparently became "burned out," the average daily gain per head during the final 17 days of the test being only 0.068 lb.

During the first 6 days after the feterita and milo maize had been supplied in the ration of lot 2 at the end of the first 59-day period, the average gain per head was increased from 0.24 to 0.42 lb. daily. After ground feterita and milo maize had been supplemented in the ration received by lot 2 the lambs did not go "off feed" as readily as when on the ration composed wholly of cotton-seed meal and silage.

The lambs of lot 1 returned a profit of $1.03 per head, and those of lot 2 82 cts. per head.

The influence of domestication on the mechanical qualities of the pars compacta of Sus scrofa domestica, together with a discussion of the theory of the functional adaptation of the skeleton, A. Schmidt (*Arch. Entwickl. Mech. Organ., 41 (1915), Nos. 3, pp. 472–534, pls. 2, figs. 5; 4, pp. 605–671, figs. 8*).—Data are given on the moduli of strength of the compact bone substance of wild and domestic swine.

In general, grazing animals show a higher modulus of elasticity and a greater firmness than those of the same age not on pasture. The specific gravity of the compacta of *S. scrofa domestica* undergoes various changes. In the metatarsal bones of the young and the tibial and metatarsal of older wild swine it is much higher than for domestic swine of the same age. The specific gravity of the compacta of Sus and Cervus is lower in the metatarsus than in the tibia.

A bibliography of references is included.

Physiology and bacon curing, K. J. J. Mackenzie and F. H. A. Marshall (*Jour. Roy. Agr. Soc. England, 76 (1915), pp. 1–13*).—It is stated that the black pigment so often found in the mammary area of sows belonging to colored breeds is in no way related to sexual changes occurring during the period of heat or œstrus. On the other hand, it is closely similar to, or identical with, the pigment of the hair, and is consequently harmless. It follows that the heavy losses sustained by bacon manufacturers owing to the presence of this pigment have been incurred unnecessarily.

Experiments have shown that the results of ovariotomy are such as to justify the operation being carried out for commercial purposes, since spayed sows tend to feed better and fatten faster than open or unoperated ones. Those cases in which sows which were supposed to have been spayed have behaved as though they were open are the result of faulty operating.

The breeding and feeding of pigs for bacon factory purposes, R. C. Simmons (*Rhodesia Agr. Jour., 13 (1916), No. 2, pp. 187–214, pls. 2, figs. 3*).—A general discussion of the type of pig required for bacon production, and of methods of feeding, care, and management, together with a number of suggested rations.

Feeding potatoes to fattening swine, W. Völtz (*Deut. Landw. Presse, 42 (1915), No. 91, pp. 771–773, figs. 8*).—It was demonstrated that it is not feasible to feed potatoes alone to growing and fattening swine, a protein supplement being essential to satisfactory development.

Feeding experiments with straw meal and cellulose material, Schneidewind (*Landw. Wchnschr. Sachsen, 18 (1916), No. 7, pp. 57–59*).—The addition of a cellulose feed, composed of 65 per cent of straw material, 20 per cent of dried potatoes, and 15 per cent of molasses, to the ordinary grain ration for swine proved to be a valuable supplement, materially increasing the gain over a grain ration alone.

Feeding pigs on the subcutaneous matter of hides intended for tanning, W. Ellenberger and W. Grimmer (*Berlin. Tierärztl. Wchnschr., 31 (1915), No. 32, pp. 373–378*).—The authors conducted experiments in feeding the subcutaneous matter of hides to swine. This feed was well liked by the pigs and produced normal development. It was found to be an excellent concentrated feed, equal in nutritive value to a mixture of crushed beans and vetches. The digestability of the protein was 21 per cent and the starch equivalent 76.4 per cent. The flesh of the swine was found to be normal in composition. The meat when cooked had an excellent flavor and in no case was any disagreeable taste detected, whether raw or cooked.

The composition of the subcutaneous matter is given as water 13.2 per cent, protein 55, fat 26.5, and ash 5.2.

Color in horses, J. W. THOMPSON (*Breeder's Gaz., 69 (1916), No. 19, pp. 1020, 1021*).—The author presents data tending to show that English racing records demonstrate that bay is predominantly a color of speed and bottom.

Licensed stallions in Utah during the season of 1915, W. E. CARROLL (*Utah Sta. Circ. 19 (1916), pp. 3–20*).—Tables showing the distribution of licensed stallions by counties and breeds for the State of Utah are given.

Capsule method of breeding mares, W. E. CARROLL and H. J. FREDERICK (*Utah Sta. Circ. 20 (1916), pp. 3–6, fig. 1*).—This circular treats of the advantages and methods of capsule breeding of mares.

Better horses for Utah, W. E. CARROLL (*Utah. Sta. Circ. 18 (1916), pp. 3–10, fig. 1*).—This circular treats of the number and prices of horses in the United States, the type of horse most in demand, the need of improvement, and the Utah stallion license law as a factor in the improvement of horses.

Some fertility experiments, B. F. KAUPP (*Poultry Item, 18 (1915), No. 2, pp. 6, 7, 86–90, fig. 1*).—Extensive data collected at the North Carolina Experiment Station indicate that under ordinary conditions a fertility of from 80 to 90 per cent should be obtained and that from 80 to 90 per cent of the fertile eggs should hatch. Fertility rapidly declines after the removal of the cocks. It is not advisable to save eggs for hatching after the male birds have been removed from the pen for five days. If the hens mated have been running with mongrel cocks all spermatozoa in the oviducts of the hens should be dead by the eighteenth day, thus making it safe to save the eggs after that time.

[Poultry husbandry] (*Minnesota Sta. Rpt. 1915, pp. 41, 42*).—It has been found that the labor cost per pound of raising chicks is greater before they are placed on range than afterward, but contrary to the opinion of some the food cost per pound is greater with the larger chicks. Chicks artificially hatched and reared were fed at less cost than when reared by the natural process, that is, when the cost of feeding the mother hens was reckoned with the cost of feeding the chicks. With a plentiful supply of skim or sour milk the feed cost per pound of chicks five weeks old or less varied from a little over 4 cts. to a little over 6 cts.

Results of experiments indicate that a confined area for breeding flocks results in an excess of infertile eggs and chicks of less vitality. Several trials with eggs from flocks confined to small yards compared with those from flocks that had free range, at least half the time, showed more than twice the percentage of infertile eggs from the flocks in the small yards.

Teaching the young stock to roost, MR. and MRS. G. R. SHOUP (*Washington Sta., West Wash. Sta. Mo. Bul., 4 (1916), No. 2, pp. 10–14, figs. 5*).—The use of a modified King ventilating system and a forced roost apparatus is described, and plans for their construction are given.

Report on experiments on the feeding of poultry and on the feeding of chickens and ducklings conducted during 1913–14, AGNES KINROSS (*West of Scot. Agr. Col. Bul. 66 [1915], pp. 22*).—Data are given on the cost of keeping poultry, the feeding of chickens from birth to a laying age, the feeding of table chickens from birth to a marketable age, and the feeding of table ducklings.

Buttermilk cheese versus meat meal in broiler duck raising, B. F. KAUPP (*Poultry Item, 18 (1916), No. 7, pp. 8–10*).—Three lots of ducks were fed the following rations: Lot 1, wheat bran, corn meal, and buttermilk cheese, 2:4:2; lot 2, wheat bran, corn meal, and beef scrap, 2:4:1; and lot 3, wheat bran, corn meal, and buttermilk cheese, 2:4:3.

The buttermilk cheese was made as follows: The fine-grained curd resulting from pasteurizing sour cream was brought into solution by a small quan-

tity of sodium hydroxid. The buttermilk was then curdled by acidifying with hydrochloric acid, and the vat of milk was heated to from 130 to 140° F. and held at this temperature for from 30 minutes to one hour. The curd was then drained, salted, and packed. The yield of finished cheese was about 12 per cent, and contained 20 per cent of protein.

At 10 weeks of age the average weight of lot 1 was 4.31 lbs. per head; of lot 2, 5.25 lbs., and of lot 3 4.62 lbs., so that the buttermilk cheese apparently did not take the place of the meat scrap. In the 10 weeks lot 1 consumed 31 lbs. of mash which cost $8.78, and lot 2 101 lbs. of mash which cost $2.34. The average weight of lot 3 at the end of 11 weeks was 5.41 lbs. During this time there was consumed 429 lbs. of mash which cost $13.21.

The high cost of the buttermilk cheese was one cause of the high cost in lots 1 and 3. If the cheese could be produced on the farm from nonsalable buttermilk, that is, buttermilk for which there is no immediate market, the cost would be merely that of converting this animal protein into a salable product, as in chick feeding.

How to start a mink ranch, R. Lewis (*Medical Lake, Wash.: Author [1916], pp. 6*).—This pamplet deals with the principles of starting a fur farm for raising mink.

DAIRY FARMING—DAIRYING.

Manual of the dairy industry, E. de Vevey (*Lausanne: Soc. Lait. de la Suisse Romande, 1916, 2. ed., rev., pp. 340, pls. 5, figs. 110*).—This book treats of the production of milk, butter, and cheese for commercial purposes.

Balanced rations for dairy stock, J. B. Lindsey (*Massachusetts Sta. Circ. 63 (1916), pp. 8*).—A revision of Circular 50, previously noted (E. S. R., 33, p. 275).

Studies on aerobic spore-bearing nonpathogenic bacteria, J. S. Lawrence and W. W. Ford (*Jour. Bact., 1 (1916), No. 3, pp. 273–319, pls. 26*).—This reports a morphological study made of the following spore-bearing bacteria in milk: *Bacillus cereus, B. subtilis, B. albolactus, B. vulgatus, B. mesentericus, B. fusiformis, B. petasites, B. cohærens,* and *B. terminalis.*

Electrical treatment of milk for infant feeding and the destruction of Bacillus tuberculosis, J. M. Beattie and F. C. Lewis (*Jour. State Med., 24 (1916), No. 6, pp. 174–177*).—In experiments with tuberculous milk it was found that electrical conditions which give at the outlet of the lethal tube a constant temperature of from 63 to 64° C. are satisfactory for the destruction of tubercle bacilli, even when these are present in such abnormal numbers as in the special sample on which the experiment was conducted.

It is concluded that the electrical method can be used successfully, but that there must be a strict adherence to certain definite conditions of measurement, rate of flow, current, density, etc.

Pasteurization in the dairy industry, O. F. Hunziker (*Cream. Jour., 27 (1916), No. 9, pp. 18, 19, 22, 29; Milk Dealer, 5 (1916), Nos. 9, pp. 4–8; 10, pp. 16–20; Cream. and Milk Plant Mo., 4 (1916), No. 10, pp. 11–17*).—This article deals with the commercial value of pasteurization, its germ-killing efficiency, and its effect upon flavor.

Standardizing cream (*Milk Dealer, 5 (1916), No. 9, p. 22*).—An accurate and simple method of standardizing cream, devised by the Dairy Division of the U. S. Department of Agriculture, is described.

Why the fat standard should be used, Hepburn (*Cream. Jour., 27 (1916), No. 10, pp. 12, 13, 15*).—The author urges the substitution of the fat for the moisture standard in determining the market value of butter. It is stated

that a fat standard would standardize all manufacture, as far as composition is concerned, and put purchasing and selling on a similar basis. The fat standard would practically regulate other constituents in butter and, by resulting in a decrease of the percentage of salt, would operate in such a way as to furnish the consumer with a milder piece of goods. This, it is thought, would increase the consumption of butter, as more butter would be consumed if of mild flavor.

Methods for testing butter fat are given.

Butter profits and losses (*Wallaces' Farmer, 41* (*1916*), *No. 19, p. 732, fig. 1*).—A chart is given showing the estimated profits and losses for the past ten years of the dairyman who makes butter or sells cream to the creamery. The butter profit and loss areas follow very closely the business profit and loss area as devised by the Babson Statistical Organization, as do also the accompanying profit and loss areas in hogs and cattle.

American cheese in England, J. G. FOSTER, E. E. YOUNG, and W. H. BRADLEY (*U. S. Dept. Com., Com. Rpts., No. 129* (*1916*), *pp. 836–838*).—A review of some of the criticisms voiced by British importers of American cheese.

Report on the work done during 1913 at the Åtvidaberg Dairy Bacteriological Institution (*Nord. Mejeri Tidn., 31* (*1916*), *No. 3, pp. 28, 29*).—In experiments at this establishment it was found that with *Bacterium glycerini* only 4 cheeses out of 25 gave better results than the control cheese, the rest being similar or poorer. Cheese in which albumin-dissolving cocci were introduced had excellent consistency. Using *B. curvatum* in Herrgård cheese gave a better taste and consistency than in the control cheeses. With *B. glycerini* in household cheese no effect was noticed.

VETERINARY MEDICINE.

Diseases of domestic animals and poultry, their cause, symptoms, and treatment, C. J. and A. W. KORINEK (*Portland, Oreg.: Korinek Remedy Co.,* [*1915*], *pp. 192, figs. 24*).—A popular work.

Tropical medicine and hygiene.—II, Diseases due to the metazoa, C. W. DANIELS (*London: John Bale, Sons & Danielson, Ltd., 1914, pt. 2, 2. ed., pp. VIII+278, pl. 1, figs. 107*).—A revised edition of part 2, previously noted (E. S. R., 24, p. 479), including a chapter on snakes, by A. Alcock (pp. 219–269).

Veterinary handbook and visiting list, T. B. ROGERS (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. 119+*[*96*]).—This pocket handbook is planned to bring together the information needed for ready reference by the practicing veterinarian (pp. 1–119). Ninety-six blank pages ruled for a visiting list are attached.

Report of the director of the veterinary institute, SOHNS (*Jaarb. Dept. Landb., Nijv. en Handel Nederland. Indië, 1914, pp. 254–279*).—This report contains a tabulated summary of the mallein and tuberculin distribution, together with comments on the prevalence of the diseases.

The occurrence and treatment of hemorrhagic septicemia, anthrax, swine fever, trypanosomiasis, piroplasmosis, and tetanus are briefly described. A short review of the veterinary course offered at the institute is included.

Reports of Drs. Veranus A. Moore, Mazÿck P. Ravenel, and William T. Sedgwick upon the federal meat inspection (*U. S. Dept. Agr., Office Sec. Circ. 58* (*1916*), *pp. 10*).—This consists of reports submitted by experts outside of this Department, who were requested by the Secretary in July, 1913, to investigate the meat inspection work. Recommendations suggested are included.

Anesthesia and narcosis of animals and birds, F. T. G. HOBDAY (*London: Baillière, Tindall & Cox, 1915, pp. XI+86*).—Particular attention is given to anesthesia of the horse and dog.

The effect of chloroform on the factors of coagulation, G. R. Minot (*Amer. Jour. Physiol., 39 (1915), No. 2, pp. 131–138*).—"Antithrombin is rendered inactive by chloroform and ether, thus allowing free thrombin if present in an oxalated plasma to clot fibrinogen. Prothrombin is not converted to thrombin by chloroform. Chloroform can precipitate both fibrinogen and prothrombin from an oxalated plasma. Chloroform does not weaken the action of a solution of pure thrombin. Ether does slightly. Antithrombin could not be recovered from chloroform or ether extracts of serum or plasma, unheated or heated to 60° C., and is not exactly identical to antitrypsin or to Doyon's antithrombin. In one chloroform-poisoned rabbit the antithrombin of the blood was decreased below normal."

The antiseptic action of substances of the chloramin group, H. D. Dakin, J. B. Cohen, M. Daufresne, and J. Kenyon (*Proc. Roy. Soc.* [*London*], *Ser. B, 89 (1916), No. B 614, pp. 232–251; abs. in Brit. Med. Jour., No. 2880 (1916), p. 388*).—The results of investigations have led to the following deductions:

"Almost all of the substances examined containing the NCl group possess very strong germicidal action. The presence in the molecule of more than one NCl group does not confer any marked increase in germicidal power. . . . The germicidal action of many of these chloramin compounds is molecule for molecule greater than that of sodium hypochlorite. Thus *p*-toluene sodium sulphochloramid with a molecular weight for the crystallized salt of 261.5 is as active as sodium hypochlorite with a molecular weight of 74. Substitution in the nucleus of aromatic chloramins by Cl, Br, I, CH_3, C_2H_5, or NO_2 groups does not lead to any very great increase in germicidal activity. More commonly there is a moderate diminution.

"The chloramin derivatives of naphthalene and other dicyclic compounds of the sulphochloramid type closely resemble the simpler aromatic chloramins in germicidal action. The few bromamins examined show a slightly lower germicidal action than the corresponding chloramins, but the sodium sulphobromamids are much more active than sodium hypobromite. It is significant that they react much more readily with amino acids and proteins than does sodium hypobromite. Derivatives of proteins prepared by the action of sodium hypochlorite and containing NCl groups are strongly germicidal. Blood serum inhibits their germicidal action to much the same extent as it does with sodium hypochlorite or the aromatic chloramins."

Chloramin, its preparation, properties, and use, H. D. Dakin, J. B. Cohen, and J. Kenyon (*Brit. Med. Jour., No. 2874 (1916), pp. 160–162*).—This paper deals with the properties, practical uses, preparation and cost, and mode of action of chloramin.

Contribution to the study of immunity, F. d'Herelle (*Compt. Rend. Acad. Sci.* [*Paris*], *162 (1916), No. 15, pp. 570–573*).—Experimental data submitted indicate that micro-organisms killed by certain essential oils, especially oil of mustard, constitute a reliable vaccine capable of producing an immunity in an animal against a disease to which it is naturally susceptible. The organism used in the experiment reported was *Bacillus typhi murium*. A single injection of the vaccine was sufficient to confer an immunity which enabled the animal to resist an inoculation of many times the lethal dose of the virulent organism.

A vaccine was also prepared by killing the micro-organism with quinin hydrochlorid, but its power to confer immunity was only relative.

Quantitative tests on the persistence of chemotherapeutic substances in the blood of man and animals, E. Boecker (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 2, pp. 148–166*).—In the blood of men, rabbits, guinea pigs, and horses, previously injected with salvarsan, a large part of the therapeutic agent was still present after one to two hours, and in the rabbit

very often after 24 hours. Optochin disappeared much more rapidly, but was still present in the guinea-pig serum two hours after an injection. It is indicated that the cellular blood elements may fix optochin to a certain degree and later release it. Formaldehyde and "rhodaform" could not be determined in the blood shortly after injection, nor could the latter be found in the bile. It is concluded that such experimental results indicate the best methods of administering therapeutic agents and the varied action of such substances in different animal species.

Further observations on the action of chemotherapeutic substances in vitro, O. SCHIEMANN (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 2, pp. 167–187*).—Salvarsan and optochin were found to be active in bouillon as well as in the serum and blood of different animals, not only in preventing the growth of the organisms but also as bactericidal agents. The inhibition of growth, however, was found to be more regular and to be valuable in determining the selective action of such substances on various organisms. The use of serum and blood of various species often yielded widely different results.

Glanders bacilli were markedly influenced by salvarsan in in vitro experiments.

The curative doses in animal experiments which alone influenced infections were such as not only prevented growth but were also sufficient for killing the micro-organisms. This difference of rapidity of action in vivo and in vitro is attributed to the slow action of the therapeutic substance and to its greatly diminished concentration in the blood stream. The results of treatment of chicken cholera infection with quinin as described by Hallenberger (E. S. R., 30, p. 286) could not be corroborated in experiments with chickens and rabbits.

Studies on antileucocytic animals, LIPPMANN (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 2, pp. 107–122*).—Two papers are presented.

I. *The mode of action of antibacterial sera and chemotherapeutic substances.*—The experimental data have shown that the intravenous injection of a bacteriotropic serum (Neufeld's pneumococcus serum) may prevent the passage of the disturbing organism into the blood stream of healthy animals. Animals treated with thorium X, however, develop a bacteriemia within eight hours. The pneumococcus serum, therefore, only prevents a pneumococcus sepsis in the presence of leucocytes.

Bacteriolytic sera (cholera) show in leucocyte-free animals in the presence of complement the same bacteriolytic action (vibriolysis) in Pfeiffer's experiment as normal animals. For bacteriolysis the leucocytes are apparently of no particular importance. Protozoa are also destroyed by chemotherapeutic agents (salvarsan) the same as in normal animals.

Contrary to these results optochin (ethylhydrocuprein) was found not to prevent a bacteriemia in animals treated with thorium. Optochin thus appears to require the assistance of the entire organism for its effective action.

II. *Contribution to the recognition of natural immunity against swine erysipelas.*—In guinea pigs injected with swine erysipelas whose leucocytes had been destroyed by thorium X the pathogenic organisms could not be established bacteriologically, while all the normal animals died from a severe bacteriemia.

It is suggested that such curative action is due to the liberation of bactericidal substances (leukins) from the dissolved leucocytes, just as the cholera vibriolysis in Pfeiffer's experiment is accelerated through the liberation of leucocyte substance by treatment with thorium.

The biological significance of unsaturated fatty acids, J. W. JOBLING and W. F. PETERSEN (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 3, pp. 292–310*).—It is shown that through the removal of the antiferment of the

antigen a greater toxicity is bestowed on the antigen, and that an increase of the antiferment titer in sensitized animals is associated with an increased resistance against anaphylactic shock.

Bacterial antiferments are thought to consist of unsaturated lipoids of the organisms, and the absolute resistance of intact organisms probably depends on a potential lipoid envelopment. Microchemical analysis revealed no increase of nonprecipitatable substances during bacteriolysis.

Complement and serum protease are not deemed identical.

The presence of protease was established in the serum of the guinea pig and rabbit. It was active in weakly acid and in alkaline solutions. Its action was markedly retarded at 56° C. and completely inhibited at 70°, was retarded by unsaturated soaps, and was nonspecific.

It is indicated that the Abderhalden reaction is accompanied by an adsorption of serum and a ferment. Specific tissue is not cleaved in the reaction, but the cleavage products originate from the serum proteins.

In the treatment of pathological cases with potassium iodid there is a constant lowering of the antitryptic titer by which the proteolytic ferments of the organism become more active. It is deemed possible that the therapeutic action of potassium iodid depends on this lowering of antiferment content.

On the serological action of boiled and unboiled milk and milk proteins, A. Versell (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 3, pp. 267–291*).—Complement-fixation tests with human, cow's, and goat's milk have shown that human milk antisera react with cow's milk and, to a slight extent, with goat's milk. Cow's milk antisera also react with human milk. In a similar manner cow's milk casein antisera and heated cows' milk antisera react with human milk casein and boiled human milk. Contrary to this, there is no reaction between human serum antisera and cow or goat serum, or between cow serum antisera and human serum. The antisera obtained by the injection of milk serum and the casein react much stronger with the whole milk than with the respective constituents used for immunization. Whole milk and milk serum antisera, even in very small quantities, cause complement deviation with the blood serum of homologous animals. The casein and heated milk antisera do not cause this deviation. Antisera obtained by the injection of boiled milk and the constituents of boiled milk showed, in general, a weaker reaction than those obtained by the injection of the raw milk and its constituents.

Of the individual constituents of milk, the milk serum shows specific characteristics as does blood serum. The animal specificity of the casein is not so regular.

It is indicated from the experiments that a specificity of milk may be considered in the sense of "organ specificity," which is principally attributable to the casein content.

The formation of specific proteoclastic ferments in response to introduction of placenta, Florence Hulton (*Jour. Biol. Chem., 25 (1916), No. 2, pp. 227–230*).—"Placental protein is not digested to any greater degree by the serum of an animal sensitized to placenta than by the normal serum. The digestive power of the serum of an animal sensitized to placenta is not increased for casein, Bence-Jones protein, phaseolin, edestin, soy-bean globulin, or milk albumin. Casein is digested to a marked degree by the normal serum, and in most cases the normal serum possesses the more marked activity. Protamin is digested to a marked degree in both cases, the injected animal showing increased activity. Gliadin is not digested to any great extent by the normal serum, but is by the serum of the injected animal. In general, it may be said

that the injection of placenta does not increase the general or call forth the specific proteoclastic ferment of the blood."

See also a previous note (E. S. R., 35, p. 179).

The Wassermann reaction in rabbits after injection with luetic liver extracts, H. Eiken (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 2, pp. 188–198*).—The injection of aqueous extracts or emulsions of luetic liver into rabbits yielded positive Wassermann reactions sooner or later, depending on the individuality of the extract. The reaction, in general, disappeared rather rapidly, but could often be obtained months after the injection. The same results were obtained by using an alcoholic extract of an aqueous extract of luetic liver. These results confirm the findings of earlier investigators.

A positive Wassermann reaction could not be obtained, however, by the injection of an alcoholic extract of human heart or an aqueous extract of the liver of nonsyphilitic children.

If the aqueous extracts were passed through a Chamberland filter their antigenic value was greatly reduced.

Some poisonous plants of Idaho (*Idaho Sta. Bul. 86 (1916), pp. 16, figs. 7*).—Brief descriptions are given of some of the more important poisonous plants of Idaho by F. W. Gail and some suggested remedies by A. R. Hahner.

Prevention of losses of live stock from plant poisoning, C. D. Marsh (*U. S. Dept. Agr., Farmers' Bul. 720 (1916), pp. 10*).—This supersedes Farmers' Bulletin 536, previously noted (E. S. R., 29, p. 280). It is pointed out that while something may be accomplished by the application of medical remedies to sick animals the main reliance in reducing losses must be upon careful management of the range and the animals upon it. Such "management should be directed to the destruction of the poisonous plants in some cases; the use of the range when the plants are not poisonous in other cases; the allotment of some ranges to animals not affected by the plants; care in driving live stock and bedding places for sheep; the elimination of fixed driveways; and to 'rotation' in the use of the range."

Acidosis and cotton-seed meal injury, C. A. Wells and P. V. Ewing (*Georgia Sta. Bul. 119 (1916), pp. 35–64, figs. 2*).—An account is given of the performance and results of an investigation conducted at the station during 1914 and 1915, the object of which was to determine the excess of acid-forming over base-forming elements in cotton-seed meal, and whether such excess causes the injury of pigs which have eaten large quantities of the meal.

The literature relating to the subject is first reviewed, in connection with which is given a bibliography of 215 titles. The investigation, which is reported in detail and includes much tabular data, is summarized as follows:

"One hundred gm. of cotton-seed meal contained an excess of acid-forming over base-forming elements equivalent to 8.21 cc. normal acid. A 30 to 40 day lethal dose of the cotton-seed meal was found to be 25 gm. of meal per kilogram live weight daily for 6-weeks-old pigs, weighing 6 to 10 kg. each, in the type of ration here fed. In feeding cotton-seed meal to ascertain its degree of injury, it seemed necessary to balance the ration, not so much as regards the nutritive ratio, but rather as to the necessary food factors, with some such substance as skim milk. The injury was manifested before death by rather constant abnormal physical and metabolic processes. As much as twice the mineral acid represented by the excess acid in a provisional lethal dose of cotton-seed meal did not injure the pigs, though it produced the metabolic changes characteristic of acidosis.

"Under the influence of cotton-seed meal injury the pigs did not deflect ammonia from urea formation to neutralize any excess acid in the food. The feeding of sodium bicarbonate did not prevent the injury. Addition of ferrous

sulphate retarded the injury. It is concluded that acidosis played only a small part, if any, in the injury produced.

In a restricted ration, such as used in one series, pigs were seriously injured or killed within four to six weeks by eating digester tankage in amounts of nitrogen equivalent to that in a provisional lethal dose of cotton-seed meal, which was approximately 15 gm. nitrogen daily for each pig. This would indicate that, if cotton-seed meal is fed in a restricted ration and in large quantities, the ration may injure and kill pigs, even though it should contain no specific toxic substance."

On the intermediate host of the lung distome, Paragonimus westermani, S. Yoshida (*Jour. Parasitology, 2 (1916), No. 3, pp. 111–118, pl. 1*).—" In Formosa Nakagawa found the encysted larvæ in two fresh-water crabs and experimentally proved that they grew up to the lung distomes. The two crabs were identified by A. Terao as follows: *Potamon* (*Geothelphusa*) *obtusipes* [*P.* (*Geothelphusa*) *dehaanii*]. Nakagawa added that a fresh-water crab (*Eriocheir japonicus*) will also probably prove to be the intermediate host.

" I have experimentally proved that the encysted larvæ of this worm are found in three species of fresh-water crabs from various districts of Japan proper. They are identified as follows: *P. dehaanii, Sesarma dehaanii*, and *E. japonicus*."

Are sarcosporidia aberrant forms of cnidosporidia of invertebrates? B. Galli-Valerio (*Jour. Parasitology, 2 (1916), No. 3, pp. 126–128*).—" The observations of Piana and Galli-Valerio to the effect that spores of sarcosporidia produce amebic bodies in cultures more closely relate the sarcosporidia to the cnidosporidia. If true that sarcosporidia are only aberrant forms of neosporidia of invertebrates, then the hypothesis of Darling becomes more probable."

The preparation of tetanus antitoxin, E. H. Ruediger (*Philippine Jour. Sci., Sect. B, 10 (1915), No. 1, pp. 31–63, figs. 85*).—From the results obtained, the authors conclude that " a suitable strain of the bacillus of tetanus will usually produce potent toxin when grown in nearly neutral glucose broth under hydrogen. The acidity of the broth will rise to more than two per cent normal acid, and it should be neutralized with sodium hydrate before it is injected into the horse. Potent tetanus toxin was obtained by the method described by Ivan Hall.[a] By this method the acid is continuously neutralized by the magnesium carbonate present.

" Horses differ greatly in the power of producing tetanus antitoxin." Of eight horses reported on, one produced 150 units, two 300 units, one 350 units, one 400 units, and three 500 or more units of tetanus antitoxin per cubic centimeter of serum. The antitoxin curve reached its highest mark in from six to nine months after the beginning of immunization.

" The injection of large doses of toxin is not indicated. The dosage should be such that the horse does not appreciably lose in weight."

The conjunctival tuberculin reaction, Besnoit and Cuillé (*Rev. Gén. Méd. Vét., 25 (1916), No. 289, pp. 9–17, fig. 1*).—The authors have found the conjunctival tuberculin reaction for the detection of bovine tuberculosis of great diagnostic value and equal to the classical subcutaneous reaction. The technique is simple and rapid and has the advantage of not causing great rises in temperature. The possibilities of diagnostic error are considerably reduced. The procedure is valuable both in investigational and in practical routine work. The authors believe that it should be substituted for the subcutaneous method, the latter being reserved exclusively for the control of uncertain cases.

[a] Univ. Cal. Pubs., Path., 1913, No. 2, p. 98.

Note on the stage of Piroplasma bigeminum which occurs in the cattle tick, Margaropus annulatus, H. CRAWLEY (*Jour. Parasitology, 2 (1915), No. 2, pp. 87–92, fig. 1*).—"A parasitic protozoan was found in smears made from female cattle ticks (*M. annulatus*) and from crushed eggs which they had deposited. The parasite has the form of a minute polycystid gregarine, and is believed to represent the stage of *P. bigeminum* occurring in the tick. It is essentially like the form figured and described by Koch as present in engorged female ticks and their eggs, and also like the form of *P. canis* found by Christophers in *Rhipicephalus sanguineus.* In the present case, it is of interest to note that the female ticks in which the parasites were found showed an unusual mortality, suggesting that the parasite is pathogenic for the tick as well as for the cow. In addition to the gregarinoid parasite a spirochete was found in the ticks. This parasite, not heretofore reported from the United States, is perhaps the same as the form known as *Spirochæta theileri.*"

Roundworms in poultry, life history and control, W. B. HERMS and J. R. BEACH (*California Sta. Circ. 150 (1916), pp. 7, figs. 3*).—A series of control experiments with *Ascaris inflexa* was conducted by the junior author in order to test the value of certain anthelmintics and other remedies, such as powdered areca nut, powdered pomegranate root bark, turpentine, gasoline, iron sulphate, and tobacco. These were given both alone and in various combinations in the form of pills or mixed with food.

Tobacco stems when finely chopped, steeped in water for two hours, and the stems and liquid mixed with the mash were readily eaten by the fowls and gave uniformly good results. The fowls which were very badly infested with roundworms were in most instances entirely freed from these parasites after two doses.

The tobacco treatment, disinfection of yards, method of handling brooder chicks, and other precautions are described.

RURAL ENGINEERING.

State rivers and water supply commission, ninth annual report 1913–14 (*Victoria Rivers and Water Supply Com. Ann. Rpt., 9 (1914), pp. 40, figs. 2*).—This reports the activities and expenditures of the commission for 1913–14, on irrigation works especially.

Report of the Water Rights Branch, Department of Lands, for the year ended December 31, 1915, W. YOUNG (*Rpt. Water Rights Branch Dept. Lands, Brit. Columbia, 1915, pp. F 56, figs. 8*).—This report for 1915 embodies a brief analysis of the work of the branch, including matters touched on in the report for the preceding year. The report of the board of investigation is also included.

Accounting and business procedure as applied to the construction of large irrigation projects, C. E. BEE (*Engin. and Contract., 45 (1916), No. 12, pp. 269–274, figs. 25*).—This article "gives a more or less complete description of the general business procedure, with the accompanying forms, suitable to the accounting of a large irrigation or hydro-electric project. All forms and reasonings are the result or outgrowth of experience. The general plan outlined is that now in use by the U. S. Reclamation Service on construction work."

Ochoco project and Crooked River investigations, J. T. WHISTLER and J. H. LEWIS (*Oreg. Cooper. Work, Dept. Int. U. S. Reclamation Serv., 1915, June, pp. 98, pls. 29*).—This report, prepared in cooperation with the State of Oregon, deals with the irrigation and water power possibilities of Crooked River basin and its relation to the lower Deschutes River power development. The features to which this report has special reference are as follows:

"(1) The Ochoco project, which will provide irrigation for 15,500 acres in the vicinity of Prineville, by storage of 40,000 acre-feet in a proposed reservoir on Ochoco Creek, 6 miles above Prineville, the spillway for which will be 113 feet above low water. The estimated cost of this project is $51.30 per acre.

"(2) The irrigation of part of the north unit lands of the Deschutes project by storage on Crooked River at the Post Reservoir site. Several alternative plans are considered, comprising a low-line development to irrigate 46,000 acres near Haystack Butte, and 9,000 across near Prineville, with 50 miles of main canal, and water by storage through the construction of a 131-ft. dam above Post at a cost of $78 per acre; a high-line development for Haystack Butte lands, and all of Ochoco project lands at a cost of $83 per acre.

"(3) A study of the availability of Crooked River storage for increasing the minimum flow of lower Deschutes River for various hydro-electric power developments proposed in U. S. Geological Survey Water-Supply Paper 344 (E. S. R., 32, p. 279). A fall of 200 to 300 ft. in lower Deschutes River must be developed before Crooked River storage at its estimated cost becomes feasible for this purpose. . . .

"A duty for water of 1.85 acre-feet per acre of irrigable land is considered reasonable for the Ochoco project on the assumption that at least one-third of the project will be in grains. . . . It is estimated that the mean run-off from Ochoco Creek is about 48,000 acre-feet, with an extreme maximum and minimum of approximately 84,000 and 22,000 acre-feet during the past 12 years. . . . Soil and agricultural surveys of irrigable lands show the soils to be from 2 to 4 ft. or more in depth, with the physical character for irrigation and cultivation good. The plant food content of the bench lands is fair and for the bottom lands excellent. . . . It is estimated that during the period 1907 to 1915, inclusive, the mean annual run-off of Crooked River at Post was approximately 216,000 acre-feet, with a maximum of nearly 350,000 acre-feet and a minimum of 125,000 acre-feet."

Irrigation pumping by electric power, G. D. Longmuir (*Jour. Electricity, 36 (1916), No. 14, pp. 259–261*).—This is a record of electric irrigation pumping in the Columbia River Valley giving comparative costs from representative plants picked at random from 110 plants with a concentrated load of over 700 horsepower. It is shown "that the plants operating as one unit secured a total of 33 in. of water for 70 acres at a total cost of $7.35 per acre against the individual operations of 35 in. per acre at a total combined cost of $11.30."

Electric irrigation pumping in Idaho, W. T. Wallace (*Jour. Electricity, 36 (1916), Nos. 12, pp. 227–230; 13, pp. 241–243*).—After tracing the recent increase in irrigation pumping, the author reviews the results of recent surveys conducted by power companies, wherein it was found that plant efficiency rather than power rates was the most important factor in power costs.

Test made of model weir, B. D. Moses (*Engin. Rec., 73 (1916), No. 15, p. 487, figs. 4*).—Laboratory investigations made at the University of California on a model reduced 7 : 1 of the so-called Dolgeville model weir calibrated at Cornell University and described in Water Supply Paper 200 of the U. S. Geological Survey (E. S. R., 19, p. 385) are reported.

It was found that above heads of 1.4 ft. on the Cornell model (0.2 ft. on the California model) the curves for the coefficient c were of the same general type, and that the coefficient for the smaller weir was greater than that for the larger. The results of this and further comparisons are thought to furnish encouragement as to the reliability of deductions from small-sized weirs.

Durability of concrete draintile, O. B. Winter and H. H. Musselman (*Michigan Sta. Spec. Bul. 75 (1915), pp. 3–13, figs. 4*).—Field and laboratory tests of concrete tile are reported.

When apparently sound tile were so placed for four months as to be exposed to the action of the elements, to the action of water in a river bed to determine the effect a large amount of water coming in contact with the surface, and to the action of sewage by placing them in the discharge waters at a sewer outlet, no effect of the exposures was observed. When porous tile were placed in soil and water caused to percolate through their walls no disintegration was observed, but analyses of the water showed that some of the cement had been dissolved.

To show the effect of soil water upon the cement in concrete tile porous cups were prepared from pure quartz sand and cement and different solutions caused to pass through their structure. The results obtained are taken to indicate that "any solution percolating through concrete tile will dissolve some of the cement; in other words, some of the material which is necessary to maintain the tile structure intact, and point conclusively to the necessity for an impervious tile wall structure. Experiments also showed that solutions would percolate through incompletely hardened tile much more rapidly than through tile that had been properly and completely hardened; so the action of solutions upon partially hardened concrete tile is greater than upon those which have been properly hardened. . . . Conclusions reached from these preliminary experiments seem to point to the following as the most important factors for consideration in manufacturing concrete tile to fulfill desired requirements:

"(1) A Portland cement, meeting the requirements of the standard specifications for Portland cement of the American Society for Testing Materials, as revised to date. (2) Clean and preferably siliceous sand, graded in size from the finer particles to those which will just pass a ¼-in. mesh screen, for all tile 10 in. and less in diameter. (3) Proper and accurate proportioning of the cement and sand. The method of measuring materials should be one which will insure separate and uniform proportions of each of the materials at all times. (4) Thorough mixing of materials, preferably by a power-operated batch mixer, and continuing for at least one minute after all materials, including water, are in the mixer. (5) Using a machine that accomplishes thorough packing of materials at proper consistency. (6) All other conditions of manufacture having been as outlined, hardening in a properly equipped and operated steam room will produce tile of the highest grade. When, however, hardening by water vapor is not possible, tile must be kept constantly wet on the surface by sprinkling with water for not less than seven days under favorable weather conditions, and longer during cold weather."

Details of these factors are discussed together with samples of concrete tile received which had failed.

Ground water in the Hartford, Stamford, Salisbury, Willimantic, and Saybrook areas, Connecticut, H. E. Gregory and A. J. Ellis (*U. S. Geol. Survey, Water-Supply Paper 374 (1916), pp. 150, pls. 13, figs. 10*).—This is a report on the origin, occurrence, distribution, and quality of the ground waters of five typical areas in Connecticut, with reference to their use for irrigation, farm domestic water supplies, and municipal water supplies.

Surface water supply of Ohio River basin, 1914 (*U. S. Geol. Survey, Water-Supply Paper 383 (1916), pp. 125+XXXII, pls. 2*).—This report, prepared in cooperation with the States of West Virginia and Illinois, presents the results of measurements of flow made on streams in the Ohio River basin during 1914.

The underground and surface water supplies of Wisconsin, S. Weidman and A. R. Schultz (*Wis. Geol. and Nat. Hist. Survey Bul. 35 (1915), Econ. Ser. 17, pp. XXII+664, pls. 5, figs. 72*).—This report, prepared in cooperation with the U. S. Geological Survey, deals with the general conditions affecting Wis-

consin water supplies and their chemical quality and describes local water supplies by counties. The first part covers the geography and geology, conditions controlling underground and artesian water, the flowing artesian wells of Wisconsin, prospecting for flowing wells, springs, and mineral waters, the general composition and uses of water supplies, chemical quality and factors affecting the mineralization of underground water supplies, and surface water supplies and their chemical quality.

Bacteria in commercial bottled waters, Maud M. Obst (*U. S. Dept. Agr. Bul. 369 (1916), pp. 13*).—Bacteriological examinations of bottled waters from 110 domestic springs are reported and discussed.

From the results obtained it is concluded that "bottled water for table use should either be actually sterile or should comply with a strict standard as to the number of *Bacillus coli* tolerated. No water should be permitted to be sold which is contaminated at the source in any manner. Inspection of springs and bottling establishments, together with the analysis of official samples, indicates that ignorance of proper precautions, carelessness, and neglect are fully as large factors in the contaminations found as are impurities actually present in the springs.

"The numbers of *B. coli* in official samples collected in the market may be safely assumed to be less rather than greater than the numbers in the freshly bottled stock. The data . . . show the need of improvement in the bacteriological condition of many of the brands of bottled water to be found in the market. Careful consideration of cases to which special study has been given shows that there are some springs used for the production of commercial bottled waters which should not be so used. It is evident that the presence of serious and unremovable contamination should shut the water of a spring permanently from the market. . . .

"The results clearly show that bottled waters can be made to conform to the requirements of the U. S. Public Health Service for drinking water furnished upon trains; that is, that not more than one 10-cc. sample out of five should show the presence of *B. coli*."

Study of the purification of water by aluminum sulphate, A. A. Bado and V. J. Bernaola (*Bol. Obras Púb. Argentina, 12 (1915), No. 4–6, pp. 185–212, pls. 4*).—Experiments on the purification of the La Plata River water with aluminum sulphate led to the conclusion that the formula $A=2\ (p-5)$ for determining the quantity of aluminum sulphate necessary for the purification of river water gives results which are unnecessarily high. In this formula A=the necessary quantity in milligrams of aluminum sulphate and p=the milligrams of calcium carbonate in the water. It is further concluded that owing to the complexity of the factors affecting the action of the coagulant it is impossible to determine exactly the quantity of aluminum sulphate necessary for thorough purification. The necessary quantity of aluminum sulphate is considered to depend on the alkalinity of the water, the organic matter content, and the matter in suspension. It is also concluded that the precipitated aluminum hydrate adsorbs organic matter in solution.

The filtering action of soil on water containing colloids, K. Sack (*Gsndhts. Ingen., 38 (1915), Nos. 46, pp. 525–528; 47, pp. 538–543, fig. 1; 48, pp. 549–555*).—Studies on the colloidal content of samples of several types of sewage and colloid-holding waters, including domestic and industrial sewage and sewage from septic and settling tanks, and experiments on the filtering and purifying action of a crystalline powder composed of the important constituents of agricultural soil, and of moor and humus soil containing much organic matter, heavy and weak loam soils, and light sand soil, are reported. The method of Marc for colloid determination was used.

The sewage of small cities was found to contain the maximum amount of colloids about noon, while purely domestic sewage contained more colloids in the morning. The colloid content comprised from one-third to one-half of the total organic content. An exchange of organic sewage colloids with inorganic colloids of the filtering material was established. It was found that the soils were able to adsorb considerably weaker colloids than the crystalline powder. Colloid adsorption by soils was effected not only by their crystalline constituents but also by their amorphus constituents. By washing out the soils with water the salts were first removed and then the colloids. The greatest part of the soil colloids was found to be of an inorganic nature, even in the moor and humus soils.

The soils adsorbed organic colloids before inorganic colloids and exchanged inorganic soil colloids for the organic putrefactive sewage colloids, so that considerably more organic colloids were fixed by the soil than their theoretical adsorptive powers indicated. Freezing and drying of soils strongly increased their peptonizing powers, especially soils rich in humus.

The colloids fixed on the surfaces of soil particles in their turn adsorbed molecularly dissolved substances whereby a more extensive power of adsorption of the soil for colloids was reached.

These results are taken to indicate that the colloid adsorbing properties of soils are the primary factors in the purification of sewage by soils, and that they act in connection with the secondary purification processes involving catalytic and bacteriological influences through the agencies of which adsorbed organic colloids are decomposed and mineralized. Further experiments along this line are in progress.

Stream pollution and sewage disposal in Illinois with reference to public policy and legislation, L. K. SHERMAN (*Ill. Rivers and Lakes Com. Bul. 16 (1915), pp. 30*).—This report deals with stream pollution and sewage treatment and reviews the laws governing stream pollution of Illinois and other States.

Second annual report of the engineer of the Oregon State Highway Commission for the year ended November 30, 1915, E. I. CANTINE (*Ann. Rpt. Engin. Oreg. Highway Com., 2 (1915), pp. 90, pl. 1, figs. 16*).—This reports highway construction and expenditures in Oregon for the year ended November 30, 1915, as conducted by the engineer of the state highway commission.

Road maintenance in the several States (*Municipal Jour., 40 (1916), No. 14, pp. 465–479, figs. 3*).—The reports of 20 state highway commissioners, engineers, or other officials are given, describing the methods most successfully employed by each in maintaining the roads of his State, together with a statement of opinion concerning the importance of road maintenance.

Maintenance of Indiana highways, G. E. MARTIN (*Purdue Univ., Dept. Engin., Highway Bul. 1 (1915), No. 1, pp. 24, figs. 10*).—The purpose of this bulletin is to present the best current practice in road maintenance operations, with special reference to the roads of Indiana. It is stated that part of the material was drawn from publications of the Office of Public Roads of the U. S. Department of Agriculture.

Economics of highway engineering, L. I. HEWES (*Cornell Civ. Engin., 24 (1916), No. 6, pp. 237–246*).—The author discusses road administration, finance, cost, traffic, and cost comparison for different types of surfaces, with reference to their bearing on highway engineering economy.

Construction field books for bituminous macadam highways, J. T. CRAWFORD (*Good Roads, 49 (1916), No. 14, pp. 164–166, figs. 4*).—Construction field books, the objects of which are to show the highway as planned, staked, and constructed, are described and illustrated, including a grade book, culvert book, stone course book, and a bituminous material book. A book for the engineer

in charge contains summaries of all items entering into the construction of the highway.

What the highway engineer should know about bituminous materials, P. HUBBARD (*Cornell Civ. Engin., 24 (1916), No. 6, pp. 260–278*).—In outlining in a general way what the highway engineer should know about bituminous materials, the author deals with the classification of bituminous materials, refining processes, petroleums, asphalts, tars, physical and chemical tests of bituminous road and paving materials, and specifications.

Road and concrete materials, H. S. MATTIMORE (*Cornell Civ. Engin., 24 (1916), No. 6, pp. 280–293, figs. 3*).—This article deals with methods of stone, gravel, and slag testing; discusses the proportioning and inspection of concrete materials; and gives tables of tests of limestone, dolomite, sandstone, quartzite, syenite, and trap from different parts of the State of New York. The results of compression tests of sand mortars and diagrams showing the effect of fine sand in concrete, the effect of tamping and moisture content on void determination in sand, and the importance of screening sand are also given.

Revised practice on road building (*Cement Era, 14 (1916), No. 3, pp. 60–61*).—The principles adopted by the Second National Conference on Concrete Road Building as representing good practice in the construction of concrete roads and pavements are given. These include sections on materials, drainage, grading, subgrade, forms, pavement section, joints, mixing and placing concrete, retempering, protection and curing, opening to traffic, one-course pavement, and integral curb.

Useful feet-miles conversion table for highway engineers (*Engin. Rec., 73 (1916), No. 15, p. 482*).—A table of figures computed for Connecticut state highway work is given.

An unusual application of the rattler test for paving bricks, F. L. ROMAN (*Engin. and Contract., 45 (1916), No. 14, p. 329, figs. 2*).—Rattler tests of partly worn paving brick blocks, using angular and spherical shots, showed abnormally high losses not only in percentage but in actual weight. "It appeared, therefore, that the blocks had a fairly hard exterior but a rather soft interior."

Drainage and preparation of subgrades, J. H. HUBER (*Cornell Civ. Engin., 24 (1916), No. 6, pp. 247–254*).—The author reviews highway drainage in general, taking up more especially underdrainage, foundation courses, culverts, and preparation of subgrades. "In the design of the drainage system of any highway, it is necessary that a survey be made by walking over it on foot and all drainage conditions noted. The best time to do this is at the time of the spring run-off and after the new grade line has been approximately fixed."

Reinforced-concrete construction.—III, Bridges and culverts, G. A. HOOL and F. C. THIESSEN (*New York and London: McGraw-Hill Book Co., 1916, vol. 3, pp. XXII+688, pls. 7, figs. 569*).—This is volume 3 of this series (E. S. R., 31, p. 186) and deals with bridges and culverts. It is divided into eight parts.

Part 1, on arch bridges, contains the following chapters: General data, deflection of curved beams, analysis of the symmetrical arch by the elastic theory, design of an earth-filled arch bridge, use of influence lines in arch analysis, unsymmetrical arches, arches with elastic piers, arch analysis by the method of the ellipse of elasticity, details of arch bridges, construction of arch bridges, three-hinged arches, and patents. Part 2, on slab and girder bridges, contains chapters on slab bridges, simple girder bridges, continuous girder bridges, cantilever bridges, and reinforced concrete in steel bridge construction. Part 3, on culverts, deals with factors in culvert design, pipe culverts, box culverts, and arch culverts. Part 4, by A. W. Ransome, contains notes on the construction plant;

part 5, by L. H. Allen, contains notes on estimating; part 6, by W. J. Titus, deals with the artistic design of concrete bridges; part 7, by A. M. Wolf, deals with the construction in detail of several types of concrete bridges; and part 8, by P. Aylett and P. J. Markmann, deals with European concrete bridges.

How the Forest Service bridges the more remote stream crossings (*Engin. Rec., 73 (1916), No. 15, pp. 485, 486, figs. 4*).—Methods of difficult but inexpensive construction as adopted by the Forest Service of the U. S. Department of Agriculture in bridging mountain streams of the Northwest are briefly described and illustrated.

Keeping the engine in good running order, C. V. Hull (*Gas Power, 13 (1916), No. 9, pp. 30, 32, 64. 66*).—Suggestions are given on the care of the valve system and the timing of valves on farm gas engines.

[**Repair of gas engines**], J. F. Hobart (*Gas Power, 13 (1916), No. 9, pp. 54, 56, 58, fig. 1*).—Information on the proper use of set screws is given.

Directory and specifications of gasoline and oil farm tractors (*Farm Machinery, No. 1277 (1916), pp. 18–20, 25*).—This directory contains specifications for 176 tractors of 98 different makes.

Directory and specifications of plows for tractor use (*Farm Machinery, No. 1277 (1916), pp. 26, 27*).—This directory contains specifications for 82 plows of 18 different makes.

The development and efficient utilization of animal, steam, electric, and internal-combustion motor plows, A. Wolff (*Beiträge zur Entwicklung und wirtschaftlichen Verwendbarkeit von Gespann-, Dampf-, Elektro- und Explosions- motorpflügen. Inaug. Diss., Univ. Giessen, 1913, pp. VIII+96*).—This report deals with the development of horse-drawn plows, steam, electrical, and motor plows, the extent to which the use of each is justified on the basis of efficiency, the relation of the cost of mechanical to animal work, and of the cost of motor to steam plowing. It is pointed out that in Germany deep plowing may be more cheaply done with mechanical than with animal power; that in such work the mechanical power works a great saving in expensive animal power, and that more actual work is accomplished per unit of time.

How to plow a field with a tractor, R. Olney (*Gas Power, 13 (1916), No. 9, pp. 10, 12, figs. 3*).—This is an illustrated description of what is considered the best method of laying out a field for plowing with a tractor.

Lighting farm buildings, J. L. Mowry (*Univ. Minn., Dept. Agr., Ext. Bul. 58 (1915), pp. 8, figs. 7*).—This pamphlet describes and diagrammatically illustrates small oil, acetylene gas, and electric lighting systems for farm buildings.

A simple ice precooling plant, Mary E. Pennington (*Proc. Amer. Warehousemen's Assoc., 25 (1915), pp. 266–272, fig. 1*).—A simple ice precooling plant designed and tested by the Bureau of Chemistry of the U. S. Department of Agriculture is described and illustrated.

"The experimental box . . . is 22 ft. 2 in. long by 11 ft. 4 in. wide by 8 ft. 10 in. high. The bunker occupies 3 ft. 8 in., leaving the box 7 ft. 6 in. wide in the clear. The wire basket holding the ice is 30 in. wide, inside measurement. The cost of such a box is approximately $800. The interior of the box was painted and enameled to insure as dry an atmosphere as possible."

Test records are also given.

RURAL ECONOMICS.

Psychic causes of rural migration, E. R. Groves (*Amer. Jour. Sociol., 21 (1916), No. 5, pp. 623–627*).—The author states that "the city furnishes forceful, varied and artificial stimuli; the country affords an environment of stimuli in comparison less strong and more uniform. Minds that crave external, quan-

titative stimuli for pleasing experiences are naturally attracted by the city and repelled by the monotony of the country. On the other hand, those who find their supreme mental satisfactions in their interpretation or appreciation of the significant expression of the beauty and lawfulness of nature discover what may be called an environment of qualitative stimulations. The city appeals, therefore, to those who with passive attitude need quantitative, external experiences; the country is a splendid opportunity for those who are fitted to create their mental satisfactions from the active working over of stimuli that appear commonplace to the uninterpreting mind."

Suggestion and city drift, E. R. Groves (*Rural Manhood, 7 (1916), No. 2, pp. 47–52*).—In this article are discussed the psychic suggestions received by boys and girls on farms from their parents, in school, and from the city itself, that tend to draw the young men and women from the rural districts into the cities and towns.

Government aid and direction in land settlement, E. Mead (*Fort Collins: Colo. Agr. Col. Ext. Serv., 1916, pp. 14*).—In this address, delivered at the 1916 session of the Colorado Farmers' Congress, the author describes the methods used in obtaining credit for land settlers in Australia and its adaptability to conditions found in the Western States.

Russian land reform, R. T. Ely (*Amer. Econ. Rev., 6 (1916), No. 1, pp. 61–68*).—This article consists of a brief description of the significance of the Russian land reform movement and comments by various authors regarding this movement.

A system of rural credits adapted to federal reclamation projects, F. H. Sears (*Fallon, Nev.: Author [1916], pp. 31*).—This pamphlet contains a brief description of the Water Users' Associations connected with reclamation projects, and of methods that may be used to adapt the Landschaft and Credit Foncier systems to the needs of farmers on these projects. It is pointed out that some system of credit is needed if the reclamation farmers are to be successful, and that the success of our reclamation work depends upon the success of the farmers.

Farmers' need for productive credits amply cared for by present facilities, P. W. Goebel (*Econ. World, n. ser., 11 (1916), No. 15, pp. 466–469*).—The author has outlined his scheme for providing credit for Kansas farmers, proposing the passage by the state legislature of an enabling act for the organization of one land bank with a capital stock of about $1,000,000. The bank would be located at the state capitol, and confine its business to the making of loans on farms occupied and cultivated by the owners, either on straight payment or upon the amortization plan.

Management of sandy-land farms in northern Indiana and southern Michigan, J. A. Drake (*U. S. Dept. Agr., Farmers' Bul. 716 (1916), pp. 29, figs. 3*).—This deals with the problems involved in the improvement and management of farms on the sandy-land areas which occur in different parts of northern Indiana, southern Michigan, and in a part of northwestern Ohio. It outlines a plan whereby a man with limited means, by beginning with suitable cash crops, may build up one of these farms and at the same time derive some revenue from it, finally developing a well-balanced farm system.

The normal stages of development suggested for the average sandy-land farm are as follows: (1) Growing and selling cash crops, among which soy beans or cowpeas for seed should have a prominent place; (2) a transition stage, in which live stock should be introduced as rapidly as fences can be purchased and built, and as the farm can be made to produce the necessary feed and pasture; and (3) a general and well-diversified farm system, with the proper balance between cash crops and live stock which will afford profitable

employment for the entire year, maintain crop production in a reasonably high state and yield a suitable labor income.

Farm management for boll-weevil conditions, J. R. FAIN (*Ga. State Col. Agr. Bul. 98 (1915), pp. 15, figs. 4*).—The author outlines two systems of management, one for diversified farming before the coming of the boll weevil, the other for a modification of the plan under boll-weevil conditions.

The farm first outlined is to consist of 200 acres, of which 50 are in pasture, 100 in a 3-year rotation of cotton, corn, and oats followed by cowpeas, and the remainder used for raising corn for silage, soy beans, and peanuts, grazing crops for hogs, a garden, and a small grass plat.

Under boll-weevil conditions, 8 of the 33⅓ acres previously devoted to cotton remain in cotton, the remainder being used either for corn and velvet beans for cattle, peanuts and soy beans for hogs, Irish and sweet potatoes, or vetch and oats for hay. The remainder of the farm is to be operated as in the first instance.

The author has also outlined a plan for a smaller farm with the same system of management.

Terminal market problems, J. E. BOYLE (*Reprint from Quart. Jour. Univ. N. Dak., 6 (1916), No. 2, pp. 159–167*).—This pamphlet consists principally of excerpts from government documents regarding terminal elevators, produce exchanges, hedging and speculation, grading and dockage, and storing and mixing. A brief bibliography is appended.

Patronage dividends in cooperative grain companies, J. R. HUMPHREY and W. H. KERR (*U. S. Dept. Agr. Bul. 371 (1916), pp. 11*).—The authors divide the cooperative grain companies into 5 classes: (1) Regularly incorporated companies; (2) single elevators organized under cooperative law; (3) the county unit plan, a number of elevators belonging to one cooperative association; (4) a similar plan but on a larger scale; and (5) similar to (4) but organized as separate county organizations to secure the benefits of trading on boards of trade.

The authors point out that the dividends may be distributed on the money value of the individual transactions or on the basis of the amount of grain contributed by the individual members.

Methods of handling patronage dividends under the various conditions mentioned above are outlined.

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 5, pp. 41–48*).—This number gives the usual monthly estimates of the farm value of the more important agricultural products, and the range of prices at important markets, with detailed statistics concerning the condition on May 1 of winter wheat, rye, hay, spring pasture, spring plowing, and spring planting.

Special reports are included on the strawberry acreage and the percentage of the total harvested each month, apiary conditions, maple sugar and sirup production and prices, the Texas Bermuda onion crop, prices of meat animals, stocks of hay on farms May 1, and yearly summaries of the world's production of important crops.

Statistics of the production of cereals and legumes (*Estadistica de la Produccion de Cereales y Leguminosas. Madrid: Junta Consult. Agron., 1914, pp. 30; 1915, pp. 31*).—These reports continue data previously noted (E. S. R., 30, p. 791).

Proceedings of the conference relative to the marketing of live stock, distribution of meats, and related matters (*U. S. House Representatives, 64. Cong., 1. Sess., Doc. 855 (1916), pp. 152, fig. 1*).—This conference, held at Chicago, November 15 and 16, 1915, under the auspices of the U. S. Department of Agriculture, was called with a view to ascertaining the essential facts and

conditions pertaining to the marketing of live stock, determining the feasibility of improving marketing methods and facilities, and promoting a better understanding among the various interests connected with the industry. The discussion covered the different phases of the production and distribution of live stock and live-stock products, beginning with the live-stock producers and ending with the retail trade.

Statistical information relating to stocks, cotton, grain, provisions, live stock, and seeds, 1915 (*Chicago: Howard, Bartels & Co., 1915, pp. 54*).—In this report are included Chicago's grain inspection rules and the daily movement and prices of agricultural products at Chicago for 1915, together with data showing by comparison the monthly movement for earlier years. Data are also given relative to the crops and trade in the principal foreign countries.

Resources of Nebraska (*Nebr. Dept. Labor Bul. 31 [1916], pp. 167*).—This report contains data showing the mortgages released and filed during the year, the surplus shipments of agricultural produce, and brief topographic notes as to soils by counties.

AGRICULTURAL EDUCATION.

Agricultural education, A. C. MONAHAN and C. H. LANE (*Rpts. Comr. Ed. [U. S.], 1914, I, pp. 291–318; 1915, I, pp. 295–316*).—A review is given of the progress in agricultural education in 1913–14 and 1914–15 in the agricultural colleges and normal, secondary, and elementary schools in the United States, agricultural education at meetings of the year, educational work of the U. S. Department of Agriculture, and the principal developments of agricultural education in other countries.

Agricultural and mechanical colleges (*Rpt. Comr. Ed. [U. S.], 1914, II, pp. 277–314*).—This is a compilation from official sources of statistics of the land-grant colleges with reference to faculties, students, courses of study, value of funds and equipment, revenues, additions to equipment, etc., together with a summary of statistics for the years 1891–2 to 1913–14 and a summary of legislative acts and appropriations in 1914 in various States.

Home economics, HENRIETTA W. CALVIN and CARRIE A. LYFORD (*Rpt. Comr. Ed. [U. S.], 1915, I, pp. 317–343*).—Following a review of the series of four bulletins on Education for the Home, by B. R. Andrews (E. S. R., 33, p. 397), the authors report on home-economics instruction in state colleges, universities, normal schools, summer schools, and public and rural schools, state supervision, state courses of study, textbooks for home economics teaching, use of apartments or houses in public-school teaching, cafeterias as practice places for home-economics teaching, rural-school luncheons and lessons in food preparation, continuation schools and home economics for adult women, home-economics education for colored students, laws affecting home-economics instruction, home-economics associations, and tendencies and developments in home economics.

Education for the home, B. R. ANDREWS (*Rpt. Comr. Ed. [U. S.], 1914, I, pp. 319–344*).—This report deals with the subject matter and method in education for the home, the status and program of education for the home, including fundamental principles and the various points in our school system and social organizations in which they find expression, and local progress in education for the home in elementary and high schools, practical household arts work in public schools, vocational classes, normal schools, and colleges.

Education for child nurture and home making outside of schools, MRS. F. SCHOFF (*Rpt. Comr. Ed. [U. S.], 1914, I, pp. 363–374*).—This is a review of what is being done in the education for child nurture and home making by organizations interested in this work, and of home education extension work of high and normal schools and colleges.

A rural school experiment, S. S. RITTENBERG (*Clemson Agr. Col. S. C., Ext. Div.* [*Pub.*], *1916, Jan., pp. 24, pls. 3*).—This is a report on the first year's work of a plan undertaken as an experiment in Darlington County, S. C., in September, 1914, for the purpose of giving agriculture in rural schools and solving the problem of the lack of competent teachers.

The agricultural instruction in five selected consolidated schools was placed in charge of J. N. Napier. Each school had three acres of land for field crop demonstrations and one acre for orchard work. The preliminary work, weekly program, classroom, field, club, and demonstration work, and the effects of the plan on the pupil, the parents, the educational conditions in the county, and the agriculture of the community at large are discussed.

During the first year the expenses were $2,500, including the salary, cost of automobile, and traveling expenses of the teacher. This year three agricultural teachers are giving instruction in 14 schools and are receiving a total of $5,700, including salaries of $2,500, $1,800, and $1,400, respectively, and traveling expenses. At present nearly three-fifths of the total enrollment of boys from the sixth grade upward are being taught practical agriculture. There are now more than 700 boys attending the public schools of the county, and under this method it is thought that five teachers can instruct all these boys in practical agriculture at a cost not exceeding $10,000 or $12,000. If the experiment proves successful after a two-year trial it is planned to adopt it throughout the State.

Elementary agricultural instruction (*Agr. Gaz. Canada, 3* (*1916*), *No. 1, pp. 60–77, figs. 5*).—This is a review and forecast of elementary agricultural instruction in the provinces of Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Manitoba, Saskatchewan, Alberta, and British Columbia.

Farm and home management schools and agricultural housekeeping schools (*Ztschr. Landw. Kammer Schlesien, 19* (*1915*), *Nos. 47, pp. 1245, 1246; 50, pp. 1317, 1318, fig. 1; 51, pp. 1342–1344, fig. 1*).—An account is given of the aim and instruction of farm and home management schools and of agricultural housekeeping schools. The former are intended for the daughters of large farm owners and for the training of teachers of home economics for agricultural housekeeping schools and itinerant cookery schools, while the latter are for the daughters of medium and small farmers. Applicants for admission to the former, especially to the seminar courses, must have completed at least a ten-year course at a higher girls' school or must take a special entrance examination, while the completion of the common school is sufficient for admission to the housekeeping schools.

Report of the department of agriculture of Sweden, 1913 (*K. Lantbr. Styr.* [*Sweden*] *Underdåniga Ber. 1913, pp.* [*10*]+*648, figs. 2*).—This report contains the usual accounts of the various agencies for the promotion of Swedish agriculture, including the work of agricultural, horticultural, dairy, and housekeeping schools and dairy, chemical, and seed-control stations.

Women's work in agriculture in peace and war (*Jour. Bd. Agr.* [*London*], *22* (*1915*), *No. 9, pp. 859–866*).—A review is given of the report of the Agricultural Education Conference on Agricultural Education for Women and of a circular letter to the secretaries of the county war agricultural committees on the employment and training of women, followed by an account of the experience of some farmers who have recently engaged women to take the place of men who have enlisted.

The Agricultural Education Conference finds that (1) the instruction available in England for women consists of courses in men's institutions which admit women students, and additional short courses or classes for women

which are attached to institutions for men; (2) that the amount of instruction offered to rural women, or young women of the tenant farmer or smallholder class, consisting of itinerant instruction and in a few counties of short courses at a farm school or similar institution, is totally inadequate. Only two of the twelve institutions which may be classed as farm schools attempt to give any practical instruction except in dairying. In the opinion of the conference the itinerant instruction should take the form of organized classes rather than lectures, especially in poultry keeping and horticulture.

The conference recommends that (1) the curriculum provided for girls should include instruction in the care of animals, the minor farm processes, and domestic economy, including fruit bottling and jam making; (2) instruction in home management should be provided for women in any grouped course of agricultural education, as in Ireland, Belgium, and Canada, where instruction in home management forms the central feature of the agricultural education provided for women; and (3) there is room for the provision, at one or more of the collegiate institutions, whether entirely devoted to women or not, of a systematic course in general agriculture comprising both the practical and scientific side, for women of the professional and land-owning classes and the daughters of the larger farmers, whether they intend to become teachers or to take positions involving management.

[Animal husbandry extension course for boys' and girls' clubs], C. A. Norcross (*Agr. Ext., Univ. Nev. Buls., 1916, Nos. 1, pp. 20, figs. 10; 3, pp. 20, figs. 14*).—These bulletins comprise the first six lessons of the course and deal with the three general divisions of cattle, viz, dairy, dual-purpose, and beef cattle, including a study of the origin of cattle, the development by breeding of the three distinct types, history and characteristics of the leading breeds of each, farm and range management, and judging cattle.

Arithmetic problems based upon agricultural club work (*N. C. Agr. Ext. Serv. Circ. 8 (1916), pp. 10–15*).—This is a series of 50 problems in arithmetic, based on corn, pig, and poultry club work and prepared for supplementary work in rural schools.

MISCELLANEOUS.

Twenty-eighth Annual Report of Louisiana Stations, 1915, W. R. Dodson (*Louisiana Stas. Rpt. 1915, pp. 32*).—This contains the organization list, a report by the director discussing the work of the stations, an account of their progress including brief departmental reports, and a financial statement as to the federal funds for the fiscal year ended June 30, 1915, and as to the state funds for the fiscal year ended November 30, 1915. The experimental work reported is for the most part abstracted elsewhere in this issue.

Twenty-third Annual Report of Minnesota Station, 1915 (*Minnesota Sta. Rpt. 1915, pp. 74*).—This contains the organization list, a financial statement for the federal funds for the fiscal year ended June 30, 1915, and for the state funds for the fiscal year ended July 31, 1915, and a report of the director summarizing the work of the station and its substations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 2, pp. 15, figs. 12*).—This number contains brief articles on the following subjects: The Root Maggot Pest, by E. B. Stookey; Plant Good Potato Seed, by J. L. Stahl; Field Corn in Western Washington, by E. B. Stookey (see p. 339); Teaching the Young Stock to Roost, by Mr. and Mrs. G. R. Shoup (see p. 377); and Preserving Eggs, by W. R. McBride.

NOTES.

Alabama College.—A state appropriation of $100 per annum for the years 1915 to 1918, inclusive, is now available for each county that raises a similar sum to be used for prizes, premiums, and other phases of boys' and girls' club work. These funds are spent under the joint supervision of the state board of agriculture and the county authorities, under plans and rules submitted by the professor of school agriculture of the college. The club work for boys in each county is also under the general supervision of the county farm demonstration agent and that for girls under the supervision of the county canning club agent.

Alaska Stations.—C. C. Georgeson, agronomist in charge, received the degree of D. Sc. from his Alma Mater, the Michigan College, at its recent commencement.

Delaware College.—Gifts have been made to the college from an unannounced donor during the past year amounting to $1,000,000, and are being utilized largely for buildings. In addition to those previously noted, Wolf Hall, named in honor of Dr. Theodore R. Wolf, who for over a quarter of a century was professor of chemistry, is now in course of construction. This building is intended primarily to house all the activities of the agricultural department, but for a time will also furnish quarters for general chemistry and biology. It will cost, partially equipped, $280,000. A new dormitory for men will also be started shortly to accommodate about 75 students.

Florida University and Station.—Dr. J. E. Turlington, superintendent of the Craven County Farm Life School, of Vanceboro, N. C., has been appointed professor of agronomy, vice W. C. Etheridge resigned to become professor of farm crops in the University of Missouri. John Belling, assistant horticulturist and editor of the station, resigned July 1.

Georgia College.—A cooperative arrangement has been made with the Office of Public Roads and Rural Engineering of this Department, whereby J. V. Phillips of that Office will be given headquarters at the college. M. D. Wood has been appointed instructor in animal husbandry and Dr. J. E. Severin, instructor in veterinary medicine.

Hawaii Federal Station.—C. W. Carpenter, of the Office of Cotton and Truck Disease Investigations of this Department, was transferred June 1 to the position of plant pathologist in charge of the new division of plant pathology.

Kentucky University.—Beginning with the new academic year, a one-year course in practical agriculture is to be offered. No entrance examinations are to be required or restrictions made as to age.

The boys' pig club work, begun in 1915, has now been extended to 40 counties with a membership of 1,250. Bankers, business men, and farmers have cooperated in the enterprise by distributing over $5,000 worth of pure-bred pigs among the members.

Massachusetts College and Station.—A special commission, consisting of the state supervisor of administration, the state commissioner of education, and

three additional members selected by the Governor, was authorized by the last legislature to investigate the general subject of agricultural education at the college and the development of the agricultural resources of the Commonwealth. This commission was directed to study and report before January 10, 1917, on the policy of the college, its use of the funds at its disposal, the advisability of further expenditures for buildings, lands, etc., the relation of the college to other agricultural institutions in the State, and similar questions. An appropriation of $7,500 was made for holding hearings and other expenses. Governor McCall has subsequently announced as his appointments to the commission, Dr. L. Clark Seelye, ex-president of Smith College, William F. Whiting, a paper manufacturer of Holyoke, and Warren C. Jewett, for many years secretary of the State Grange.

The department of botany has been reorganized with A. V. Osmun in charge. Beginning September 1, Orton L. Clark, assistant plant physiologist, will devote part time to instruction work, and Dr. P. J. Anderson, associate professor of botany, will give part time to the station as associate plant pathologist

W. A. Allen and T. L. Harrocks have been appointed assistant chemists, the former in the fertilizer section and the latter in the feed and dairy sections. C. L. Beals has been assigned to chemical work in nutrition. George L. Farley, superintendent of schools in Brockton, has been appointed supervisor of junior extension work, this dealing with the boys' and girls' clubs and similar activities.

Mississippi College and Station.—W. C. Trotter, of Winona, and J. S. Howerton, of Baldwyn, have succeeded E. M. Clark and T. W. Carter, as members of the board of trustees.

Minnesota University and Station.—R. W. Thatcher has been appointed assistant director of the station.

The division of agricultural chemistry has been reorganized as the division of agricultural biochemistry, and will provide for instruction and research in plant chemistry, biochemistry, cereal technology, and methods of agricultural chemical analysis. Dr. R. A. Gortner has been appointed associate professor of biochemical research and associate agricultural biochemist of the station, and George E. Holm research assistant in agricultural biochemistry.

The work relating to animal production has been organized into an animal industry group, which includes the divisions of animal husbandry, dairy husbandry, poultry husbandry, animal nutrition, and veterinary science. Dr. C. W. Gay, professor of animal husbandry in the veterinary college of the University of Pennsylvania, has been appointed professor of animal husbandry and animal husbandman, and will be chairman of the group and of the animal husbandry division. H. H. Kildee, professor of animal husbandry and assistant chief of dairy husbandry in the Iowa College and Station, has been appointed professor of dairy stock and production and chairman of the dairy husbandry division.

Missouri University and Station.—Hereafter all dairy products used by the university are to be purchased or manufactured by the department of dairy husbandry. This policy is adopted to insure pure dairy products for use in the various university dormitories and incidentally makes it possible for more complete instruction to be given by the department.

The Iowa College conferred the honorary degree of D. Sc. on C. H. Eckles at its last commencement.

The resignations have been accepted of C. B. Hutchison as professor of farm crops, J. G. Watson as extension assistant professor of dairy husbandry, M. A. R. Kelley as instructor in agricultural engineering, and B. E. Sive as assistant in agricultural chemistry. Recent appointments include E. W. Lehmann, assistant professor of agricultural engineering at the Iowa College, as associate professor

of agricultural engineering; A. C. Ragsdale, instructor in dairy husbandry at the West Virginia University, as extension assistant professor of dairy husbandry; W. A. Albrecht as instructor in soils; R. A. Kinnaird, instructor in agriculture at the Maryville State Normal School, as extension instructor in soils; H. G. Newman as assistant in veterinary science; P. H. Ross, county agricultural agent of Leavenworth County, Kans., as county agent leader; Harry T. Bennett as assistant in agricultural chemistry; Dr. E. H. Bullock as assistant in the agricultural extension service; and J. H. H. Mote as district agricultural agent in the Ozark region.

Montana College and Station.—Resignations are noted of G. E. Smith as assistant chemist, effective August 1, and D. C. Wood, as assistant professor and assistant in farm management, effective September 1, the latter to accept a position as extension professor of farm management in the University of Missouri.

Nebraska University and Station.—The erection of the agricultural engineering building has been postponed on account of the present high cost of construction. Bids for erecting this building have twice been advertised for and refused. It is probable that another effort will be made to secure bids about March, 1917.

Frank C. Dean has resigned as agricultural editor to accept a similar position in the Ohio State University, effective September 1.

Nevada Station.—The collection has been begun of certain lupines poisonous to live stock for the purpose of extracting the poisonous principle and studying its chemical nature. A new line of work planned is a study of methods of avoiding the heavy losses now experienced in bringing sheep through the period of spring starvation when they are coming from the winter ranges of the southern deserts to the lambing grounds in the northern portion of the State.

Rutgers College.—Alva Agee, director of the division of extension in agriculture and home economics and professor of soil fertility, has been appointed secretary of the new state board of agriculture. John H. Hankinson has been appointed state leader in farm demonstrations and Alexis L. Clark has resigned as assistant state leader.

Cornell University and Station.—The state fiscal year has been changed to end June 30 instead of September 30 so that it now coincides with that of the Federal Government. This is proving to be of great convenience to the college of agriculture, particularly in the administration of its projects under the Smith-Lever Act.

A. R. Mann, formerly secretary of the college of agriculture, has been appointed acting dean and director beginning August 1.

The summer session of the forestry school was attended by about 30 seniors and graduate students as compared with about 20 the previous year. The program included practical woods work in the neighborhood of Lake Saratoga, where because of the nearness of fairly large centers of population there is a close utilization of forest products and a type of lumbering different from that studied in the Adirondacks in 1915. G. H. Collingwood has been appointed extension professor of forestry, vice R. D. Moody resigned to become a member of the Wisconsin conservation commission.

Clinton DeWitt Smith, instructor in extension teaching and widely known as an educator in both North and South America, died at Buffalo, N. Y., August 5, while on a lecture tour for the college of agriculture. Professor Smith was born at Trumansburg, March 7, 1854, was graduated from the university in 1873, and taught in the Star Military Institute and practiced law for brief periods. He became assistant agriculturist in the station in 1890, director of the Arkansas Station in 1891, and director of the Minnesota Station and professor of dairy

husbandry from 1891–1893. In the latter year he went to the Michigan College as professor of agriculture, continuing in this position until 1899. In 1895 he was also made director of the Michigan Station, and in 1899, dean of the department of special courses and superintendent of farmers' institutes. In 1908 he accepted the presidency of the Louis Queiros School of Agriculture of Sao Paulo, Brazil, returning to this country after a five-year period of service in 1913. His subsequent life was spent on his farm at Trumansburg and in the extension service of the college of agriculture.

New York State Station.—John C. Baker, Ph. D. (Columbia, 1916), has been appointed associate chemist. William W. Baer has been appointed assistant chemist for work in the agronomy department, succeeding E. J. Lewis resigned to engage in commercial work.

Ohio Station.—Recent appointments include Wayne Van Pelt as assistant in botany, W. C. Gangloff as assistant in chemistry, and H. J. Conlin as assistant in soils. C. E. Mangels, assistant in agricultural chemistry at the Missouri University and Station, has been appointed assistant in nutrition beginning September 1, succeeding Chas. M. Fritz resigned.

Oregon College and Station.—Farmers' days have recently been held at the Moro dry-farming substation and the Eastern Oregon substation near Union. The institutions were opened to inspection and the leading experimental work was explained to hundreds of farmers.

A West-side Farmers' Week was conducted by the college extension service at McMinnville, July 3 to 8, with more than 1,000 farmers and their wives in attendance.

Gilbert B. Posey, research assistant in botany, has been appointed scientific assistant in forest pathology in this Department.

Porto Rico Insular Station.—During the past year experimental plantings have been made of pineapples, vegetables, grapefruit, and other economic plants. About 300 tons of seed cane were distributed and the station has about 1,000 seedlings under test. Excellent results are reported by planters with D–117 and B–208.

Work with citrus diseases, analyses of tropical fruits, and a citrus survey are being begun. About 8,700 packages of plants, 5,000 of fruits, and 1,000 of seed were inspected under the plant quarantine. An appropriation of $1,000 was made by the Porto Rican legislature for the construction of a plant house.

George N. Wolcott has resigned as assistant entomologist to complete Ph. D. work at the University of Illinois.

Tennessee University.—C. Elmer Wylie has been appointed assistant in dairying beginning June 15.

Utah College and Station.—The station office building has been thoroughly renovated and the station library rearranged to make its material more readily accessible. The mailing service for all publications of the institution, including those of the college, station, and extension division, has been reorganized to promote efficiency in sending out printed matter. A conference of the agronomy workers of the eleven Rocky Mountain and Pacific Slope States was held at the college July 18–20.

N. I. Butt, fellow in agronomy, has been appointed assistant agronomist and H. P. Anderson assistant chemist and bacteriologist. Other appointments in the station include Orson P. Madsen as assistant poultryman, vice A. D. Egbert, resigned; N. E. Edlefsen as assistant meteorologist; and W. J. Merrill as secretary to the director. George Stewart and H. R. Hagan, instructors in agronomy and entomology, respectively, have been granted leaves of absence for the ensuing year to pursue graduate work in Cornell and Harvard universities.

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U. S. DEPARTMENT OF AGRICULTURE

STATES RELATIONS SERVICE

A. C. TRUE, DIRECTOR

Vol. 35 OCTOBER, 1916 No. 5

EXPERIMENT STATION RECORD

WASHINGTON

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1916

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- College Station: *Auburn;* J. F. Duggar.[a]
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Meteorology, Soils, and Fertilizers {W. H. Beal. / R. W. Trullinger.}
Agricultural Botany, Bacteriology, and Plant Pathology {W. H. Evans, Ph. D. / W. E. Boyd.}
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FORESTRY.

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AGRICULTURAL EDUCATION.

MISCELLANEOUS.

LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

[a] Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

Vol. 35. October, 1916. No. 5.

The seventh session of the Graduate School of Agriculture, under the auspices of the Association of American Agricultural Colleges and Experiment Stations, was held July 3–28 at the Massachusetts Agricultural College. This institution has a regular graduate school, whose director and faculty were especially active in assisting the dean in planning and conducting this summer graduate school. The attempt was made to develop a more systematically organized plan of work at this session than had hitherto been undertaken. This plan involved work in two main lines. One of these included progressive consideration of the fundamental factors involved in the growth of plants and animals. The other dealt with the economic and social factors which enter into the development of profitable systems of agriculture and well-organized rural communities. The fact that the Massachusetts College has been giving special attention to the problems of rural economics and sociology made it very appropriate that an effort should be made to summarize the present status of knowledge along these lines in their particular relations to American conditions.

The total enrollment of instructors and students was one hundred and ninety-eight, representing twenty-seven States, besides the District of Columbia, Porto Rico, England, Canada, and the Transvaal.

There were forty-five persons who gave instruction as lecturers or leaders of seminars, and about forty others who participated in the formal presentation of matter in the seminars and conferences. The faculty included representatives of the Universities of Illinois, Missouri, Chicago, Harvard, and Yale, the United States Department of Agriculture, the Missouri Botanical Garden, Amherst College, London Hospital Medical College, Massachusetts State Board of Education, Vermont Department of Agriculture, Kalamazoo Normal School, and the agricultural colleges and experiment stations in Indiana, Kansas, Massachusetts, New Hampshire, New York, Ontario, Oregon, Pennsylvania, Vermont, West Virginia, and Wisconsin. Dr. A. C. True of the States Relations Service again acted as dean, with Dr. C. E. Marshall, dean of the Graduate School of

the Massachusetts Agricultural College, as assistant dean and Mr. E. H. Forbush of the college as registrar.

At its public opening exercises the school was welcomed to the Massachusetts Agricultural College by President K. L. Butterfield, and the Granges of New England were represented by Rev. J. H. Hoyt. Director H. P. Armsby, of Pennsylvania, as chairman of the association's committee on graduate study, presided at this meeting and spoke on the development of graduate study in agriculture in the United States. He gave recently collected statistics showing that about one thousand graduate students preparing for work along agricultural lines were enrolled in the land-grant universities and colleges during the past academic year. Dean True, of the Graduate School, outlined briefly the objects for which the school was established, the reasons for the particular courses of instruction offered at the seventh session, and the intellectual and social advantages to be derived from the contact of instructors and students in such a school.

Dr. True pointed out that in our time "education and research more and more involve the harmonious working together of groups of individuals who are willing to put away selfish ends for the common good. In a vast country like our own with a population drawn from all quarters of the globe, and with an almost infinite variety of environmental conditions, associations of scholars and investigators from many different regions, whether their work deals with subjects remote from practical affairs, or as in the case of most of us with matters of vital concern to great industries, is of great importance as an aid to that mutual understanding on which the life of our nation and the perfecting of our civilization depend. For after all, as recent events in the world's history have shown, public opinion and governmental action depend, more largely than is generally recognized, on the modes of thought which are developed in the institutions of higher learning.

"Such an organization as this Graduate School, having behind it the associated universities and colleges represented in the Association of American Agricultural Colleges and Experiment Stations, may also be influential in shaping the ideals and standards of agricultural scholarship and research. If through our discussions here we are able to carry back to our respective institutions suggestions for the improvement of courses of instruction and methods of research and to stimulate faculties and students to more thorough work, we shall have made a valuable contribution to those influences which are to determine the success of the great movement to raise American agriculture and country life to the highest possible level.

"Since the last session of our school this movement has made unusually rapid progress. The permanent national system of agricultural extension education, provided for in the Smith-Lever Act of 1914, has already become well organized and attained great dimensions. In over one thousand two hundred counties, spread over the entire country, extension agents are regularly working. Supporting these local forces are about one thousand five hundred extension specialists and administrative officers maintained by the state colleges and the Department of Agriculture. At least one thousand teachers are giving instruction in agricultural subjects in our colleges, and the numbr of students in four-year courses of agriculture has risen from 14,000 in 1913, to 19,500 in 1915. The past year 4,900 secondary schools gave agricultural courses attended by 95,000 students, as compared with 1,400 schools and 30,000 students two years before. The force employed in our agricultural experiment stations has risen to 1,860 and the income of the stations in 1915 was $5,286,000. The force employed in the Department of Agriculture is over 16,000 and its income about $25,000,000.

"The demand for thoroughly trained and efficient workers in agricultural lines, whether in research, education or farm practice, has never before run so far beyond the supply. The rsponsibilities of the leaders in the agricultural movement have never been so heavy. Their encouragements have never been so great. This body of young men, who have already been trained in our higher institutions of learning and many of whom are already engaged in teaching or research, have before them exceptional opportunities for leadership and high success. The incentives to thorough preparation and the most strenuous endeavor are of the highest and broadest character. To discover nature's secrets and thereby advance science and human welfare, to inspire and instruct a vast multitude of men, women, and children in colleges, schools, and millions of homes, to lay a firm and safe foundation for the permanent existence and prosperity of the United States and in large measure of all the world—these are the appropriate tasks of agricultural scholars and scientists."

The course on growth consisted of twenty lectures and nineteen seminars, covering the four weeks of the session and including the general subjects of the dynamics and elemental chemical synthesis of growth, cell entity or growth organization, and growth relations. In the first week Prof. C. M. Child, of the University of Chicago, gave five lectures on the general dynamics of protoplasm, the organic individual, unity and order in growth, development and evolution, and reproduction. He paid special attention to an analysis of his own experimental studies on the dynamics of form production, as shown by some of the lower animals. The presence of a chief axis

of growth and of minor axes was recognized, and the results of studies on planarian worms and on hybrids were held to demonstrate the existence of metabolic gradients along these axes. The behavior of an excised piece of the body of one of these animals was shown to have a definite relation to the region of the body from which it was taken, and the reconstitution of parts was shown to proceed at a rate and in a way that were in definite relation to the metabolic gradient involved.

The dedifferentiation of the cells of the bodies of these sample animals was affirmed. The importance of dedifferentiation in producing the embryonic condition in somatic cells was emphasized in its relation to rejuvenescence and reproduction. The theory of a germ plasm, universal in the Metazoa, contained in cells separate from the soma was held to be compromised, if not invalidated, by the fact that differentiated somatic cells in these simple organisms can be brought into the embryonic condition and made to function in the reconstitution of the organism. Reproduction becomes a phase of general growth dynamics and related to metabolic factors.

Dr. V. E. Shelford, of the University of Illinois, as leader of the seminars, supplemented Professor Child's discussion by accounts of the studies by himself and others regarding the intimate influence of environmental factors on metabolic processes, interpreting life cycles, and even morphogenesis, in these terms.

In the second week Dr. Benjamin Moore, formerly of the University of Liverpool and now connected with the London Hospital Medical College, presented the elemental chemical synthesis of growth. He discussed, among other things, the energy transformations in metastable inorganic colloidal systems and the morphological changes accompanying them, and showed how certain products of the inorganic systems closely simulate living structures. It thus appears altogether probable that in the process of evolution inorganic matter passes into organic through a synthesis involving an uptake in energy and an increase in molecular complexity. The cell as an energy transformer was considered, and the relation of the action of light on formaldehyde in high concentrations and upon organic products formed in life processes was demonstrated. Some attention was also given to other photosynthetic actions and the theories of photosynthesis, as well as to the relationships of a physico-chemical basis for the origin of life to Pasteurism, evolution, and heredity.

Dr. E. V. McCollum, of the University of Wisconsin, as leader of the seminars that week, discussed the fundamental food requirements of animals in the light of recent investigations on the kinds and combinations of food nutrients and feeding stuffs necessary for

normal growth in small and large animals—rats, swine, and cattle. He emphasized especially the importance of exact knowledge as to the source, chemical composition, and relative proportions of the nutrients used, and the essential need of the presence of food, though in very small amounts, of at least two unknown substances.

In the third week, Dr. B. M. Duggar, of the Missouri Botanical Garden, gave five lectures on cellular entity. In these the present-day knowledge and theories were clearly and impartially summarized, including the morphology, structure, and chemical composition of the individual cell, semipermeable membranes and related phenomena, cell correlation in relation to growth, cell organization in respect to reproduction, and the activities of the cell in regeneration. At the seminars Dr. L. J. Henderson, of Harvard University, took up the subject in its purely physico-chemical aspects and dwelt particularly on the laws and hypotheses fundamental to our knowledge of the cell, together with some of the more philosophical considerations of the subject.

Growth relations was the general topic of the lectures of Dr. H. C. Cowles, of the University of Chicago, during the last week of the course. Among the subjects treated were germination and growth, vegetation activity in relation to light, water, etc., and reproductive behavior as influenced by external factors. Plant interrelations were also considered, such as antagonisms, illustrated by parasites and epiphytes, the struggle for existence, including the ecology of weeds; beneficial relations, as illustrated by soil bacteria and fungi, and reciprocal relations, as exhibited by legumes with bacteria, trees with root fungi, etc. In connection with mass relations, soils and climates as factors in associational development and change in composition in relation to change in environment were discussed, and finally the application of ecological factors to problems of crop production was instructively presented. At the seminars Dr. Henderson discussed the physico-chemical properties of environmental factors, with special reference to hydrogen, oxygen, and carbon, in their more important combinations, and closed with some of the philosophical aspects of environment.

Parallel with the general course on growth an adjunct course which embraced a systematic review of physico-chemical elements involved in growth and their relation to biological processes was given by Messrs. Anderson, Itano, Robbins, Chapman, and Clark of the Massachusetts College faculty.

A week was devoted to discussions of the problems of education with special reference to the training of students along agricultural lines. Dr. W. C. Bagley, director of the school of education of the University of Illinois, gave five lectures on the foundations of peda-

gogy. He argued that not only knowledge but "skill" is a legitimate and important end of education, whether the subject taught is what is ordinarily called cultural, such as language and mathematics, or technical, as engineering and agriculture. The interrelations of technical and cultural aims in education were also dwelt upon. A clear and impartial résumé of the experimental researches on the disciplinary value of various studies was given, with the conclusion that the evidence thus far accumulated indicates that there is a certain disciplinary result which may be transferred from one study to another but that this is not so large as has been commonly held by the friends of the old classical education.

Dean W. W. Charters of the School of Education of the University of Missouri presented some of the principles on which methods of teaching should rest. He laid special stress on the principle that the normal mental process in learning is to work from problems toward their solution. A problem arising in the experience of the student or being presented to him by his teacher, the learner may become in large degree his own instructor, especially if the solution is of vital interest to him. The application of this principle would in many subjects result in economy of mental effort, increase of interest, and more permanent results. Good method should always culminate in elaborated and well-organized knowledge.

At the seminars the practices of teaching various agricultural subjects were presented by Dean R. L. Watts of Pennsylvania State College on vegetable gardening, Prof. C. G. Woodbury of Purdue University on pomology, Prof. C. A. Zavitz of Ontario Agricultural College on agronomy, and Prof. J. E. Rice of Cornell University on poultry husbandry, as well as by members of the Massachusetts College faculty and others. On Saturday a conference on the training of men for agricultural service was led by President H. J. Waters, of the Kansas Agricultural College, who dwelt on the nature and function of the college course in its adaptation to this end, and by Prof. G. A. Works of Cornell University who discussed the relation of the agricultural college to the preparation of teachers of agriculture in secondary schools.

The conference was followed by a round-table discussion by teachers of secondary agriculture on the value of the college courses in agricultural education as a means of preparation for teaching agriculture, this meeting being one of the series of conferences held during the past year through the coöperation of the United States Bureau of Education and the States Relations Service. During this educational week emphasis was often laid on the importance of training in the principles and methods of education for students intending to become teachers of agricultural subjects in colleges or schools.

The economic factors connected with agricultural production were discussed during the second week of the school. Mr. E. H. Thomson, of the Office of Farm Management, with the aid of lantern slides showed the geographical range of different staple crops and the results of surveys by that office to determine the various natural and economic factors which underlie the successful production of crops. Prof. J. A. Bexell, of the Oregon Agricultural College, gave five lectures on agricultural accounting and business methods, in which he illustrated and emphasized the importance to the farmer of definite knowledge regarding the actual income and outgo connected with his farming operations.

At the seminars of this week the different factors of production and their correlation were presented by Prof. M. B. Cummings of the University of Vermont for pomology, Prof. L. C. Corbett of the Bureau of Plant Industry for market gardening, Prof. E. A. White of Cornell University for floriculture, Prof. E. Rasmussen of the New Hampshire College for dairy husbandry, and Prof. J. E. Rice for poultry husbandry, and these subjects were further discussed by members of the Massachusetts College faculty representing the respective industries. During this week also the Scientific Basis of Agriculture formed the subject of two evening conferences, led by Director W. H. Jordan, of the New York Experiment Station, who emphasized the importance of strictly scientific investigations as a basis for the improvement of agricultural practice, and the necessity of employing thoroughly trained experts to give their time fully to such work.

Distribution and marketing of farm products were the economic subjects discussed during the third week. Dr. L. D. H. Weld, professor of business administration of the Sheffield Scientific School of Yale University, defined marketing in its relations to the general subject of economics, described and discussed the functions of middlemen, the factors involved in the cost of distribution of agricultural products, the weaknesses of present methods of marketing and their remedies, and the methods which should be used in investigating marketing problems. He compared the methods of marketing agricultural and manufactured products, and illustrated his subject with numerous references to his own studies in both fields.

Mr. C. J. Brand, Chief of the Office of Markets and Rural Organization, described the federal and state organizations for improving market conditions, and discussed uniform standards of market grades and packages, methods of sale of agricultural products, cooperative marketing in the United States, and the cotton marketing system in this country.

At the seminars many phases of the marketing problems as related to various agricultural industries were presented and discussed.

Mr. H. C. Thompson, of the Bureau of Plant Industry, spoke on vegetables, Professor White on flowers, Professor Rasmussen on dairy products, and Dr. E. W. Benjamin, of Cornell University, on poultry products. Mr. V. K. McElheny, of New York City, president of the American Fruit and Produce Auction Association, presented the function of the auction as a marketing agency; Mr. C. R. White, of Ionia, N. Y., considered the place of the cooperative exchange; Mr. W. J. Thurston, of the Cooperative Flower Exchange of Boston, dealt with the practical problems connected with the sale of flowers; Mr. E. S. Brigham, commissioner of agriculture of Vermont, treated of the sale of dairy products; and Mr. F. G. Urner, of New York City, and Mr. H. J. Bird, of the produce department of Swift & Co., dealt with the sale of poultry products. A number of members of the Massachusetts Agricultural College faculty supplemented these discussions with matters connected with marketing as related to their specialties.

At the evening conference, Dean J. L. Coulter, of the College of Agriculture of the University of West Virginia, led the discussion on farm finance and explained the principles and operations of the Federal Farm Loan Act. At the Saturday conference on the topic, Making the Farm Pay, Prof. G. F. Warren, of Cornell University, discussed the factors of profit in farming in the light of certain farm management investigations in New York.

The work of this week showed how great has been the advance in recent years in the collection and consideration of definite data on marketing and other economic problems in agriculture in the United States, as well as the rapid progress in the establishment of state and federal agencies for the study of these problems and the giving of assistance in their practical solution.

In the fourth week, Prof. H. C. Taylor, of the University of Wisconsin, under the head of Land Problems, discussed the social and economic factors determining the types of farming and the proper degree of intensity of culture in agricultural production, the helps and hindrances to land ownership, the forms of land tenure, land values, capitalization, and amortization.

President Butterfield summarized in three lectures important results of his studies on organization as a condition of rural social growth. He defined rural organization as the systematic and progressive assembling of all those forces and agencies which make for the sound development of the business and life of rural people and for the adjustment of their highest welfare to the common good. Great stress was laid on the proper organization of the local rural community as a basis for organization in the broad units. In this connection he said:

"The local community becomes both the beginning and the end of social effort; the beginning because it is the most efficient method of correlation; the end because if you have a true rural democracy in a multitude of these small neighborhood units—that is, a multitude of groups of farmers, each group of which is reasonably prosperous, fairly free, and socially alive, then you have a national rural democracy, and you can not get it in any other way, because there is no such thing as a democracy made up of isolated individuals. The very essence of democracy is cooperation. But this cooperation is practicable only in small groups, not in the mass. In developing this community we shall need to define the community, to make a community study, to have a community plan, to have a community council or committee, to establish a community conference, and to have a physical community center.

"In the same fashion the State should be organized on behalf of rural improvement and adjustment. Without going into detail, this may be illustrated by two things that have been done in Massachusetts. The first was the organization of the Massachusetts agricultural development committee, which for a year has been working on the following task, not yet completed: (1) Outlining methods and plans for a study and mapping of the agricultural resources of the State; (2) outlining a plan for the development of agriculture and country life of the commonwealth; and (3) recommending the form of organization and work for different agencies interested in rural life and the best way of correlating their activities. Massachusetts has also a State federation for rural progress which attempts to serve as a sort of clearinghouse for all the different institutions of the State. Obviously these two agencies need correlation.

"In a broad sense (1) the goal of rural endeavor is to build an adequate rural civilization based on the interests both of the farming class (and the individuals who compose it) and of society as a whole; (2) the condition which most completely governs the rural social growth implied in achieving this sort of rural civilization is contained in the idea of organization, or the correlation of those forces and agencies on which we must mainly rely for improvement and adjustment; and (3) the practice of rural organization involves the utmost efficiency in each rural agency, the carrying out of definite plans or projects of improvement looking toward definite industrial and social ends, and the unifying of rural forces and agencies within certain geographical areas, notably in the local community and in each State as a whole."

Dr. Ernest Burnham, of the Normal School of Kalamazoo, Michigan, considered in two lectures the creative relation of leadership to rural organization. He defined the object of leadership to be the begetting, or discovery, of a dynamic sense of progress in individuals and institutions and the constant revivification of this sense in action.

At the seminars, Mr. C. W. Thompson, of the Office of Markets and Rural Organization, introduced the discussion of the community survey and the community club. Prof. John Phelan, of the Massachusetts College, spoke on the human element in rural improvement, and Dr. L. H. Bailey gave addresses on the characteristics and functions of the editor and the coming range in the work of the agricultural college. Dr. Bailey laid great emphasis on the need of thoroughly trained, competent, and academically free teachers and investigators, and deprecated what he considers the present tendency to impose too formal and binding requirements on college and station officers as exemplified in certain forms of so-called "projects." Several members of the Massachusetts College also took part in the seminars of this week. At the closing evening conference, Prof. E. L. Morgan spoke on a Massachusetts achievement in rural improvement, summing up what has been done in that State in a practical way in effecting local, county, and State organization for the advancement of agriculture and country life.

The Graduate School thus presented a well-rounded course, starting with the question of the origin of living from nonliving matter and dealing in order with the chemistry, physics, and biology of the soil; the growth relations of plants and animals; the economic factors of production, distribution, and marketing of farm products; and finally, with the potentialities and possibilities of life in the open country. The course recognized and emphasized the importance and significance of thinking out rural life problems "from the soil to the soul." The fundamental principles of common interest to all students of scientific agriculture were emphasized rather than economic applications in specialized lines of industry, no attempt being made to deal with any special line in a complete way. The course was especially suggestive to investigators and should have been helpful to those entering upon the work of investigation. Emphasis was constantly placed, directly or by inference, upon the importance of dealing with agricultural problems at first hand and of having accurate, live, first-hand information for this purpose. This was most strikingly illustrated in the case of the discussion of questions of rural economics and sociology.

As regards the amount and high character of the work done, this session of the Graduate School was fully as important and successful as any which have preceded it. The local arrangements for the school were very good, and the courses of instruction were loyally supported and largely attended by the relatively large force now employed by the Massachusetts College. The attendance from outside, however, while representing all sections of the United States, was disappointingly small in the aggregate.

It is evident that the causes which have operated to keep down the attendance at other recent sessions have increased in influence and were not overcome by unusually active measures to advertise the school this year. Among these hindrances, the most potent seem to be the great increase of summer work and other burdens on members of the college faculties, the opening up of greater opportunities for regular graduate work in agriculture at numerous institutions, and the inability of the Association's Graduate School, under present conditions, to give credit for the work done there which might be used elsewhere as part of the requirements for advanaced degrees.

The future status of this Graduate School, therefore, needs very careful consideration by the association and its constituent institutions when the question of the next session is taken up.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Biochemical changes in cotton seed in storage, J. B. RATHER (*Arkansas Sta. Bul. 125 (1916), pp. 3–18*).—Studies are reported of the changes in stored cotton seed with reference to the loss of vitality and the availability from the standpoint of the cotton-seed-oil mill and the live-stock feeder.

The fat in ground cotton-seed was found to hydrolyze rapidly into fatty acids. This hydrolysis may amount to 85 per cent of the fat in three weeks.

In cotton-seed from seed cotton gathered dry and stored for three weeks in a common farm cotton house and in a cotton-oil mill seed house in lots of 4,500 and 7,500 lbs., respectively, no appreciable changes except a reduction in the moisture content occurred. Dry cotton seed stored in a common farmhouse in a 3,000-lb. lot in a pile 12 by 12 by 4 ft. did not deteriorate during the period of oil-mill operation. A slight loss of moisture in the samples caused correspondingly small increases in the percentage of protein and fat. The free fatty acids in the fat and the total acidity of this seed did not increase to any significant extent. Cotton seed stored in an oil-mill seed house in a 5,000-lb. lot in a pile 12 by 12 by 6 ft., dried out in storage and then heated. During heating the free fatty acids in the fat increased from 2.26 to 11.89 per cent, and the total acidity from 28 cc. of normal alkali per kilogram of seed to 91 cc. A slight protein hydrolysis was observed.

The free fatty acids in the fat of samples of fresh cotton seed at the time of picking was less than 2 per cent of the fat, and the total acidity of the seed was about 26 cc. of normal alkali per kilogram of seed. It is deemed probable that the increase in the free fatty acids and in acidity is due to heating and not to aging of the seed. Cotton seed stored in lots of 1,000 lbs. did not deteriorate in storage.

It is indicated that in extreme cases of heating the carbohydrates, fats, and proteins of the stored seed are attacked, and analytical data submitted show that the hydrolysis of the fat may reach 70 per cent and that of the protein 35 per cent. When cotton seed heats the fats decompose the most readily, and it was observed that this may take place to a considerable extent before the other constituents begin to undergo change. The acidity of fresh cotton seed is regarded as due only partially to fatty acids from the fat, but it is pointed out that in heated seed the content of free fatty acids is as great as, or greater than, is necessary to account for the total acidity. It is concluded that unless cotton seed heats badly the meal made from it will be as valuable for feeding as meal made from unheated seed, but that the oil from even slightly heated cotton seed is worth considerably less than oil from fresh seed.

Note on American charlock oil, H. S. BAILEY and L. B. BURNETT (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, p. 429*).—The authors report the physical and chemical constants of the expressed oil, the ether extract, and the petroleum ether extract obtained from pure charlock (*Brassica arvensis*) seed. It is indicated that the oil can be used in soap making and possibly in cheap paints. Its value for food purposes has not been investigated.

Ceanothus velutinus (snow brush) as a source of wax and tannin, C. C. SCALIONE and H. S. BLAKEMORE (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 411–413, figs. 2*).—*C. velutinus* was found to contain 7.3 per cent wax and 17.3 per cent of tannins. The wax was largely composed of free hydrocarbons and free cerotic acid, together with palmitic and stearic acids in combination with ceryl and myricyl alcohols. A trace of glycerids was also indicated. The tannin was of the catecholic variety. Tanning tests have indicated that a suitable extract can be prepared from the leaves.

Cyanogenesis in plants. Studies on Tridens flavus (tall red top), A. VIEHOEVER, C. O. JOHNS, and C. L. ALSBERG (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 141–150*).—The presence of hydrocyanic acid in the common grass *T. flavus*, has been confirmed. Considerable quantities were present in the plants collected in August, while only a trace was found in the plants collected in September and none in the October plants. The maximum amount of acid was found in the inflorescence tops, with only a trace in the roots and none in the seeds.

No free hydrocyanic acid was obtained by direct distillation with steam. Previous maceration with water resulted in a loss of acid. When tartaric acid was present during the maceration of the plant all of the cyanid was recovered. In the presence of sodium hydroxid the loss of added cyanid was complete. This loss during maceration is deemed to be probably due to a chemical reaction.

The presence of an amygdalin-hydrolyzing enzym in *T. flavus* was also established.

The separation of autogenous and added hydrocyanic acid from certain plant tissues and its disappearance during maceration, C. L. ALSBERG and O. F. BLACK (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 133–140*).—It has been shown that "the leaves of *Prunus virginiana* must be distilled with acid four hours before all of the hydrocyanic gas is liberated, whereas in Andropogon and Panicularia less than one hour is sufficient to liberate all hydrocyanic acid present."

When plant tissues which contain hydrocyanic acid, or to which cyanid has been added, are macerated a certain portion of the hydrocyanic acid is converted into such form as not to be recoverable by distillation with sulphuric acid. This is not due to the action of enzyms or to the presence of glucose. It is indicated that in determining the hydrocyanic acid in plants several methods in corroboration of one another should be used.

The distribution of maltase in plants.—I, The function of maltase in starch degradation and its influence on the amyloclastic activity of plant materials, W. A. DAVIS (*Biochem. Jour., 10 (1916), No. 1, pp. 31–48, figs. 2*).—It is indicated that maltase is probably present in all plants in which starch degradation occurs. The facts that the enzym is endocellular and therefore not easily extracted and is also unstable account for the failure of earlier workers to detect the presence of the enzym generally. The action of the enzym is greatly inhibited or even destroyed at temperatures above 50° C. and is destroyed by ordinary alcohol or chloroform.

Maltase occurs in considerable quantities in germinated and ungerminated cereals, and is probably localized mainly in the aleurone layer of the endosperm. If the kilning has been at a temperature sufficiently low not to destroy the enzym it may be present in malt. Its presence in malt or malt diastases would explain the formation of glucose from starch, which has previously been attributed to other causes. Maltase of plants does not act directly on starch or dextrins, but only on maltose which has been formed by diastatic enzyms.

A direct cleavage of glucose from starch never occurs. The action of the enzyms of germinated barley on starch is very similar to that of taka-diatase, the latter, however, being richer than the barley in maltose-forming enzyms, so that the dextrin stage is passed through more rapidly. In either case the glucose is formed by the action of maltase on maltose. In determining the diastatic activity of plant material in preparations such as taka-diatase and pancreatins the presence of maltase should be taken into account.

The distribution of maltase in plants.—II, The presence of maltase in foliage leaves, A. J. Daish (*Biochem. Jour., 10 (1916), No. 1, pp. 49–55*).—The presence of maltase in the leaves of Tropæolum, potato, dahlia, turnip, sunflower, and mangold, whether picked at night or in the daytime, has been demonstrated by the production of reducing sugars through the action of macerated leaves on soluble or gelatinized starch. In the presence of an excess of starch the conversion is generally incomplete. Under these conditions the action of the endocellular maltase is limited because of its low solubility and power of diffusion. On this account maltose is nearly always found among the products.

The distribution of maltase in plants.—III, The presence of maltase in germinated barley, A. J. Daish (*Biochem. Jour., 10 (1916), No. 1, pp. 56–76, fig. 1*).—The presence of maltase which hydrolyzed maltose to glucose in air-dried germinated barley was demonstrated by allowing the finely powdered grains to act on starch or maltose at 38° C. The action on starch is very similar to that of taka-diastase, which contains maltase in addition to the ordinary diastatic enzyms.

The action on germinated barley probably takes place in the following series of stages: Starch→soluble starch→dextrins→maltose→glucose.

The self-digestion of the barley starch is largely inhibited during the process of digestion of added starch until the greater part of the latter is converted into glucose. A correction for the enzymic material used, therefore, can not be applied by carrying out a control in the presence of water alone.

In the digestion of gelatinized starch by germinated barley dextrin, maltose, and glucose are found even after prolonged periods. The glucose steadily increases, however, in amount during the whole period of digestion, with a consequent decrease of the other saccharids.

Observations on beet and potato tyrosinase, M. Gonnermann (*Chem. Ztg., 40 (1916), No. 16–17, pp. 127, 128*).—The author has demonstrated that the tyrosinase prepared from the potato possesses agglutinating properties which are specific for sheep corpuscles. The tyrosinase from beet juice possessed no agglutinating property but was hemolytic. This latter property is attributed to the presence of saponins which are so combined with the enzym as to make their complete separation impossible. The presence of the saponin was established by confirmatory tests. The potato tyrosinase used was a glycerin extract 14 years old but as active as a fresh preparation.

The enzyms of cacao, H. C. Brill (*Philippine Jour. Sci., Sect. A, 10 (1915), No. 2, pp. 123–133*).—"The pulp surrounding the cacao bean contains a greater number of enzyms than the fresh bean itself. The pulp shows activity for the enzyms casease, protease, oxidase, raffinase, and invertase. The fresh bean gave reactions for casease and raffinase, and very strong reactions for oxidase. The fermented bean reacted for casease, protease, oxidase, diastase, raffinase, and invertase."

Protease and invertase were present in the fermented bean as well as in the pulp, but were absent in the fresh bean. It is indicated that these enzyms must have penetrated the membrane surrounding the bean during fermentation. Diastase was also present in the fermenting bean, which was probably devel-

oped in the bean during the process of fermentation. It is concluded that "the presence of these enzyms undoubtedly influences the character of the fermentation and that temperature control during fermentation is necessary in order that they may not be destroyed."

Standard methods of sampling and analysis and standard samples, W. F. HILLEBRAND (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 466–469*).—This aricle reviews the subject in brief and gives the standard methods recognized by courts of law in the United States, the methods not having legal recognition but approved by scientific or technical organizations, and the methods in use in laboratories of certain industrial establishments.

A diagram for the calibration of volumetric apparatus and the reduction of the volumes of liquids to a standard temperature of 20° C., H. C. DEMING (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 451–453, figs. 3*).—This article describes in detail the construction and use of the diagram which the author has devised for the rapid calibration of volumetric apparatus and the reduction of volumes of liquids to standard temperatures.

The admissibility of ammonium-magnesium phosphate as a form in which to weigh phosphoric acid, W. JONES (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 87–91*).—Analytical data submitted indicate that in the quantitative determination of phosphoric acid the conversion of ammonium-magnesium phosphate into magnesium pyrophosphate is superfluous, since accurate and concordant results can be obtained by direct weighing of the crystalline precipitate. When dry the ammonium-magnesium phosphate can be easily and completely removed from the filter paper.

Estimation of carbon dioxid as barium carbonate applied to the Marr method for determination of carbonates in soil, C. J. SCHOLLENBERGER (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 427, 428*).—Experimental data obtained at the Ohio Experiment Station from a series of six soils by boiling with 1:10 hydrochloric acid at atmospheric pressure and by several modifications of the Marr method (E. S. R., 22, p. 511) are submitted.

A comparison of the permanganate methods for the determination of required oxygen, J. H. SACHS (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 404–406*).—Analytical data obtained from a study of the various modifications for the determination of required oxygen in water are submitted. The method described by Thresh (E. S. R., 29, p. 506) of titrating in an acid medium after incubating at 37° C. is considered to be the best.

The analysis of proteins.—I, The estimation of arginin by decomposition with alkali, R. H. A. PLIMMER (*Biochem. Jour., 10 (1916), No. 1, pp. 115–119*).—Experimental data indicate that arginin can be accurately estimated by boiling with 20 per cent sodium hydroxid instead of 50 per cent, as originally recommended by Van Slyke (E. S. R., 26, p. 22). The loss of determinations through the action of the alkali on the glass is thus avoided. Copper flasks were not found satisfactory, especially in the presence of histidin, as under these conditions the histidin undergoes considerable decomposition. Boiling in a glass flask causes a slight decomposition of histidin, but the error is practically negligible. It has been found to be more convenient to add an equal volume of 40 per cent NaOH than to weigh the correct amount of solid reagent. By using a solution of alkali a larger volume of liquid is contained in the flask, which obviates the subsequent distillation after the reaction is complete, as is necessary in the original procedure.

For the determination of the total nitrogen of the bases it is recommended to use a fresh portion of the solution of the bases rather than the residue from the arginin estimation, on account of the unavoidable bumping and consequent loss of nitrogen.

The recovery of copper sulphate from the filtrates in sugar determinations by using Fehling's solution, KRUMHAAR (*Chem. Ztg., 40 (1916), No. 24, p. 174*).—The following procedure is recommended:

The clear filtrate is sufficiently heated on the water bath and enough sugar solution added to reduce the copper. The precipitated cuprous oxid is washed several times by decantation, filtered on a porcelain filter, and washed free from alkali. It is then treated in a beaker with 200 cc. of concentrated hydrochloric acid, heated on the water bath, and the copper oxidized by the repeated additions of small amounts of hydrogen peroxid. The cupric chlorid solution thus formed is evaporated nearly to dryness, an excess of dilute sulphuric acid added, and the hydrochloric acid expelled by repeated evaporations to dryness and re-solution in water. Finally, the concentrated solution of copper sulphate is filtered and poured into about three volumes of 96 per cent alcohol. A pure, fine crystalline salt is obtained which is filtered on a Buchner funnel and washed with alcohol.

The estimation of reducing sugars by Kendall's solution and the construction of a table indicating the reducing power of levulose, EDITH G. WILSON and W. R. G. ATKINS (*Biochem. Jour., 10 (1916), No. 1, pp. 137–141*).—The authors have found Kendall's procedure, previously noted (E. S. R., 28, p. 111), for the determination of reducing sugars to be very satisfactory. The copper oxid is not, however, determined by the iodimetric method, as originally recommended, but by conversion of the cuprous into cupric oxid. The presence of citric acid interferes seriously with the accuracy of the method.

A table for converting milligrams of cupric oxid to milligrams of levulose is included.

The analysis of maple products.—VIII. The application of the conductivity and volumetric lead subacetate tests to maple sugar, J. F. SNELL and G. J. VAN ZOEREN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 421, 422*).—It has been demonstrated that "pure maple sugars converted into sirups give conductivity values and volumetric lead numbers within the limits found in genuine maple sirups."

See also a previous note (E. S. R., 35, p. 206).

Solubility data for various salts of lauric, myristic, palmitic, and stearic acids, C. A. JACOBSON and A. HOLMES (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 29–53*).—Tabular data as to the solubility of the lithium, magnesium, beryllium, barium, lead, and silver salts of lauric, myristic, palmitic, and stearic acids are submitted in detail. The data include solubility figures in two or more of the following solvents: Water, ethyl and methyl alcohol, ethyl ether, benzene, ethyl acetate, methyl acetate, amyl alcohol, amyl acetate, chloroform, and acetone, at room temperature, 25, 35, and 50° C. wherever the boiling point of the solvent permitted. The preparation of the salts, together with the methods used for determining the solubility, is also described.

The data indicate that the solubility of all the salts of the four fatty acids in the various solvents tried is very slight. Considerable differences are found, however, not only among the several salts in the same solvent but also for the same salt in the different solvents. Methyl alcohol was found to be the best general solvent for these salts.

These data were obtained in connection with work on the constituents of alfalfa-seed oil, previously noted (E. S. R., 34, p. 710).

The separation of lauric and myristic acids from each other and from mixtures of other fatty acids, C. A. JACOBSON and A. HOLMES (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 55–61*).—The authors describe a method for the separation of lauric acid when present in a mixture of myristic, palmitic, and stearic acids, and also a method for the separation of myristic acid from a

mixture of lauric, palmitic, and stearic acids. The methods are based on the differences of solubility of the lithium and magnesium salts of the acids in water and 50 per cent alcohol.

Determination of tartaric acid, B. G. HARTMANN, J. R. EOFF, and M. J. INGLE (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 422–425*).—After preliminary experiments on the earlier methods for the determination of tartaric acid, the authors have modified the method of Halenke and Möslinger [a] and describe their procedure as follows:

For wines 100 cc. of the sample is neutralized with sodium hydroxid, and to the neutralized wine is added a molecular equivalent in grams of powdered tartaric acid corresponding to the amount of alkali required for neutralization. After complete solution of the tartaric acid 2 cc. of glacial acetic acid and 15 gm. potassium chlorid, together with 15 cc. of 95 per cent alcohol, are added. The mixture is well stirred until precipitation has started and allowed to stand overnight at a temperature not above 15° C. The solution is then filtered through either a Gooch crucible prepared with filter paper pulp or a Buchner funnel fitted with hardened filter paper, using gentle suction. The precipitate is washed with three portions of 7 cc. each of a solution composed of 100 cc. of water, 15 gm. of potassium chlorid, and 20 cc. of 95 per cent alcohol. The precipitate and paper are transferred to the original beaker with 50 cc. of hot water, brought to the boiling point, and immediately titrated with tenth-normal sodium hydroxid, using phenolphthalein as indicator. A correction of 1.5 cc. added to the burette reading is necessary for solubility. This corrected reading, multiplied by 0.015 and subtracting the amount of tartaric acid added, is the total tartaric acid in the wine in terms of grams per 100 cc. Rochelle salts may be used in place of tartaric acid.

In artificial products containing free phosphoric acid and alcohol satisfactory results with the method could not be obtained. The results were consistently low, due to the formation of ester in the presence of the mineral acid. The amount of ester was found to increase with the age of the sample. To obviate this source of error 5 cc. of normal sodium hydroxid in excess of that required for neutralization was added to 50 cc. of the solution under examination, heated to boiling, and allowed to stand overnight. The determination was then carried out in the usual manner.

The analysis of nonalcoholic lemon and orange extracts, E. L. REDFERN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, p. 421*).—After some preliminary experiments the method described by Howard (E. S. R., 20, p. 113) was found to be satisfactory and to yield concordant results.

Some qualitative tests for gum arabic and its quantitative determination, C. E. WATERS and J. B. TUTTLE (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 413–416*).—The qualitative tests commonly recommended for gum arabic are briefly reviewed. The most characteristic test was found to be the precipitate with basic lead acetate. Mixtures of copper sulphate and sodium hydroxid and of neutral ferric chlorid and alcohol were also found to be valuable as confirmatory tests.

After considerable preliminary experimentation a quantitative procedure was devised and is described in detail.

On the drying of sugar beets and other agricultural products and by-products, A. GRÖGER (*Arch. Chem. u. Mikros., 9 (1916), No. 1–2, pp. 1–47*).—This article discusses the subject in some detail and indicates the economic importance of the drying of agricultural products. Some experimental and statistical data are included.

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[a] Ztschr. Analyt. Chem., 34 (1895), No. 3, pp. 263–293.

Evaporation of apples, J. S. CALDWELL (*Washington Sta. Bul. 131 (1916), pp. 7–110, figs. 24*).—The author believes that under Washington conditions low-grade apples may be most easily and profitably utilized by the construction of evaporators.

The operation of small evaporating plants is not deemed profitable and is not recommended. An evaporator of a capacity of not less than 400 bu. of apples per day should be used to insure a safe margin of profit.

The kiln or hop drier, the tunnel evaporator, and what is termed the Carson-Snyder or all-purpose evaporator are recommended as adapted for use under Washington conditions. The kiln drier is considered slightly the cheapest, both in construction and operation, and gives excellent results with apples, but is not well adapted to the drying of peaches, berries, or prunes.

The construction, equipment, and operation of the three types of evaporators recommended is described in detail. Estimates on the construction and operation of the plants are also submitted. It is indicated that "1 bu. of C grade or of good cull apples will yield 6.75 to 7.5 lbs. of fruit having 25 per cent moisture content, the exact yield varying with variety as well as with size and quality of fruit."

The total cost of evaporation will also vary for the different plants described, but, by the use of machinery and reducing the hand labor to a minimum, will range from 15 to 16.5 cts. per bushel.

Apple drying, J. FARRELL (*Jour. Dept. Agr. Victoria, 14 (1916), No. 4, pp. 196–211, figs. 13*).—These pages contain a general discussion of the subject and a description of the method and apparatus used for this purpose in Victoria, Australia.

Jelly investigations, W. V. CRUESS and J. B. MCNAIR (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, pp. 417–421*).—The authors have investigated at the California Experiment Station (1) the suitability of various fruits and vegetables for jelly making, (2) yields of jelly from various fruits, (3) clarification of jelly stock, (4) loss of fresh fruit flavor in jelly making by hydrolysis and evaporation and the production of jellies without application of heat, and (5) effect of sugar and acid concentrations on jelly.

Grapes, apples, loganberries, blackberries, lemons, and pomelos were in all cases found to contain sufficient acid and pectin to give satisfactory jellies. Oranges always contained enough pectin, but were often low in acid. When mixed with lemons in the proper proportion, however, they yielded satisfactory jellies. Apricots and cherries in general were not satisfactory because of a deficiency in pectin. Pomegranates and strawberries did not contain enough pectin, although the acidity was sufficient. Peaches, pears, and huckleberries were deficient both in pectin and acid. Figs and citron melons yielded satisfactory products when acidified with citric acid or lemon juice.

Laboratory tests indicated a maximum yield of 392 gal. of jelly per ton of oranges and lemons used in the ratio of two oranges to one lemon. From a ton of loganberries 467 gal. of jelly could be prepared.

Casein and egg albumin were unsatisfactory as clarifying agents for the jelly. Spanish clay in from 10 to 20 per cent suspensions followed by heating to 100° C. yielded satisfactory results.

The loss of fruit flavor in jelly making was found to be due to decomposition by heat and to direct loss by volatilization. The optimum range of acidity for the production of satisfactory jellies was found to be between 0.5 and 1.5 per cent.

To prevent spoilage by molds and yeasts where jellies were inoculated with these organisms a Brix degree of 65 was found necessary. Jellies which re-

tained the aroma and flavor of the fresh fruit were prepared at room temperature by adding enough sugar to the juice from fruits high in pectin to increase the Brix degree to 65. Loganberries and currants were especially adapted to this procedure.

Jellies, preserves, and marmalades, AGNES E. HARRIS (*Fla. State Col. for Women Ext. Bul. 6 (1916), pp. 28, figs. 2*).—This bulletin includes suggestions and recipes for the preparation of jellies, marmalades, and preserves.

Preserving at home, EMILY RIESENBERG (*Chicago: Rand McNally & Co., 1916, pp. 32*).—This small volume briefly discusses the principle of canning and preserving fruit, molds and molding, sterilization, selection of fruit, fruit jars and glasses, utensils for preserving, preparing fruit for all kinds of preserving, sealing and storing fruits, and keeping fruit clear, and gives recipes for canning fruit and vegetables and preparing jam and preserves, jellies and marmalades, sweet pickled fruits, beverages, homemade pickles, and condiments.

Proceedings of the thirty-first annual convention of the Association of Official Agricultural Chemists, 1914 (*Jour. Assoc. Off. Agr. Chem., 1 (1915), No. 3, pp. IV+353–529; 1 (1916), No. 4, pt. 1, pp. 531–599; 2 (1916), No. 1, pt. 1, pp. 91*).—This is a detailed report of the proceedings of the convention held at Washington, D. C., November 16–18, 1914, previously noted (E. S. R., 32, p. 294).

METEOROLOGY.

Monthly Weather Review (*U. S. Mo. Weather Rev., 44 (1916), Nos. 3, pp. 111–175, pls. 21, figs. 16; 4, pp. 177–242, pls. 10, figs. 12*).—In addition to weather forecasts, river and flood observations, and seismological reports for March and April, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during March and April, 1916; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 3.—Convection in the Upper Regions of the Sun's Atmosphere, by F. Henroteau; Seesaw of Pressure, Temperature, and Wind Velocity Between Weddell Sea and Ross Sea, by R. C. Mossmann; Atmospheric Pollution in English and Scottish Towns, by J. B. C. Kershaw (see p. 420); Atmospheric Pollution, by W. P. Wynne (see p. 420); Some Problems of Atmospheric Electricity, by G. C. Simpson; Rainfall Data of Berkeley, Cal. (illus.), by W. G. Reed (E. S. R., 35, p. 116); Distribution of Cyclonic Precipitation, by T. Terada; On Pressure-change Charts (illus.), by E. H. Bowie; Fire Weather Warnings, by H. E. Williams; River-stage Forecasts for the Arkansas River, Dardanelle to Pine Bluff, Ark. (illus.), by H. W. Smith; Disappearance of Snow in the High Sierra Nevada of California, by A. J. Henry; Southern Appalachian Earthquake of February 21, 1916 (illus.), by W. J. Humphreys; and Observations of an Earthquake in a Telescope, by W. P. Hoge.

No. 4.—Total Radiation Received on a Horizontal Surface from the Sun and Sky at Madison, Wis., April, 1911, to March, 1916, by H. H. Kimball and E. R. Miller; Local Circulation of the Atmosphere (illus.), by W. H. Dines; The Planetary System of Convection (illus.), by W. R. Blair; The Average Internal Curve and Its Application to Meteorological Phenomena (illus.), by W. J. Spillman, H. R. Tolley, and W. G. Reed; A Correlation Between the Rainfall of North and South America (illus.), by H. H. Clayton; Report of the Meteorological Station at Berkeley, Cal., 1914 (illus.), by W. G. Reed; A Centigrade Thermometer Scale Preferred; Marcellus Hartley Memorial Medal, 1916; Use of "Indian Summer" in 1778? Need for Pan American

Meteorological Cooperation; Symons Memorial Medal, 1912; Dates of Opening of Navigation through Lake Pepin, 1861–1916; and Snow Surveys in City Creek Canyon, Utah, 1914–1916 (illus.), by A. H. Thiessen.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander, D. Potter, and J. S. Sims (*Massachusetts Sta. Met. Buls. 329–330 (1916), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1916, are presented. The data are briefly discussed in general notes on the weather of each month.

[Amount and composition of rainfall at Georgetown, Demerara, 1910–1914], J. B. Harrison (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914–15, pp. 38–40, App. I, p. 6*).—Monthly and annual averages of the amount and composition (chlorin, nitrogen as ammonia, and nitrogen as nitrates) of rainfall are shown for 25 years—1890–1915.

"In round figures the mean annual rainfall during the 25 years . . . was 98 in. The average rain water contained per liter of water at 84° F. 5.428 mg. of chlorin, 0.0315 mg. of nitrogen in ammonia salts, and 0.0705 mg. of nitrogen in nitrates. During the 25 years the monthly ranges of variation in the constituents of the rain have been very wide, chlorin ranging from 1.77 to 42.552, nitrogen in ammonia from 0 to 1.275, and nitrogen in nitrates from 0 to 0.823 mg. per liter of water at 84°." The average annual rainfall per acre during the period was 97,611 tons, "containing chlorin equivalent to 203 lbs. of common salt and 2.6 lbs. of combined nitrogen in the forms of nitrates and of ammonia."

Atmospheric pollution, W. P. Wynne (*Abs. in Rpt. Brit. Assoc. Adv. Sci., 1915, p. 388; Nature [London], 96 (1915), No. 2407, pp. 442–444, figs. 3; Sci. Abs., Sect. A–Phys., 19 (1916), No. 218, p. 55; U. S. Mo. Weather Rev., 44 (1916), No. 3, p. 114*).—This is an abstract of a paper read at the Manchester meeting of the British Association for the Advancement of Science, 1915, based upon monthly results of chemical examinations of rain water collected at four places in Sheffield. The records cover the period from July, 1914, to June, 1915. The results show certain discrepancies which lead to the conclusion "that the method of measurement usually adopted does not afford a reliable indication of the real degree of atmospheric pollution, and that better results might be obtained if a feasible method could be devised for drawing air continuously through water and measuring the amount of the impurities extracted in this way."

The character and extent of atmospheric pollution in English and Scotch towns, J. B. C. Kershaw (*Engineer [London], 120 (1915), No. 3125, pp. 473–475, figs. 2; Metallurg. and Chem. Engin., 13 (1915), No. 16, pp. 967–971, figs. 6; abs. in Sci. Abs., Sect. A–Phys., 19 (1916), No. 217, p. 6; U. S. Mo. Weather Rev., 44 (1916), No. 3, p. 114*).—This article summarizes and discusses the results of observations on atmospheric pollution in ten English and six Scottish towns during the winter months, October to March, of 1914–15.

It is shown that the dust fall for the English towns during the six months varied from 532 tons per square mile for Oldham to 32 lbs. per square mile for Malvern. The dust deposits were found to consist chiefly of tar, solid carbonaceous particles, and ash, the relative proportions of these not varying widely in the different towns. In the Oldham dust the proportions were 1.5 per cent of tar, 29 of carbonaceous matter, and 69 of ash. As a general rule the percentage of ash has been found to be highest and of tar and soot lowest in manufacturing districts. The observations in the Scottish towns were less complete and are not strictly comparable with those of the English towns. It is claimed that Oldham with a winter soot- and dust-fall at the rate of 1,064 tons per square mile per annum is comparable with Pittsburgh, which

has been reported to have an average fall of 1,031 tons per square mile per annum.

The connection between sunlight, pure air, and health is discussed, attention being called especially to the screening effect of dust-polluted air. Experiments made at Manchester are cited to show that "on a sunny day no less than 12 per cent of the sunlight is cut off in the last 100 ft. of the atmosphere."

International catalogue of scientific literature. F—Meteorology (*Internat. Cat. Sci. Lit., 13* (*1916*), *pp. VIII+137*).—"The literature indexed is mainly that of 1913, but includes those portions of the literature of 1901–1912 in regard to which the index slips were received by the Central Bureau too late for inclusion in the previous volumes." The sections on the relation of climate to agriculture, forestry, and geography and geology, and on phenology contain some 73 references having more or less direct bearing upon agricultural production.

SOILS—FERTILIZERS.

The soil and its cultivation, P. Diffloth (*Le Sol et les Labours. Paris: J. B. Baillière and Sons, 1916, 4. ed., rev. and enl., pp. 572, figs. 204*).—This is the fourth revised and enlarged edition of this book (E. S. R., 18, p. 316). It is divided into four main parts, as follows: Agrology, soil cultivation, soil improvement, and reclamation of waste soils.

Soil survey of Clay County, Georgia, W. G. Smith and N. M. Kirk (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 46, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture and issued May 31, 1916, deals with the soils of an area of 133,760 acres lying within the Coastal Plain province in southwestern Georgia. The topography is generally level or gently rolling with deep, narrow valleys along the streams. "The drainage system is quite complete, reaching into every part of the county, although the streams are still actively cutting."

"The soils of the county are comprised broadly in two divisions or soil provinces, (1) the Coastal Plain soils, or soils of the uplands, and (2) the alluvial soils, consisting of (a) the stream terrace soils and (b) stream bottom soils. The Coastal Plain division includes unconsolidated old sedimentary materials—beds of gravel, sand, clay, and sandy clay—and still older (underlying) beds of consolidated material, chiefly limestone."

Including meadow and rough gullied land, 26 soil types of 13 series are mapped, of which the Norfolk fine sand is the most extensive, covering 21.4 per cent of the area. "There are no soils of sufficient extent or agricultural value to dominate the agriculture of the region."

Soil survey of Turner County, Georgia, E. C. Hall and D. D. Long (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 28, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture and issued June 3, 1916, deals with the soils of a well-drained area of 177,920 acres in south-central Georgia, the topography of which ranges from undulating to rolling. The soils of the county belong in the Coastal Plain and river flood plains soil provinces and are of sedimentary and alluvial origin. Including swamp, 12 soil types of 7 series are mapped, of which the Tifton, Norfolk, and Plummer sandy loams occupy 31.3, 30.4, and 17.6 per cent of the area, respectively.

Winnebago County soils, C. G. Hopkins, J. G. Mosier, E. Van Alstine, and F. W. Garrett (*Illinois Sta. Soil Rpt. 12* (*1916*), *pp. 76, pls. 2, figs. 7*).—This is the twelfth of the Illinois county soil reports.

Winnebago County is located in northern Illinois in the Iowan and pre-Iowan glaciations and is covered with a deposit of drift, loess, and alluvial material. The soils of the county are divided as follows: (1) Upland prairie soils, rich in organic matter. These were covered originally with prairie grasses, the partially decayed roots of which have been the source of the organic matter; (2) upland timber soils, including practically all of the upland that was formerly covered with forests; (3) residual soils, including stony loam and rock outcrop; (4) terrace soils, which include bench lands or second bottom lands; (5) late swamp and bottom land soils, which include the overflow lands or present flood plains along the streams and other poorly drained lands." Of these the brown silt loam and brown sandy loam of the upland prairie soils cover 21.35 and 19.1 per cent of the area, respectively, while the yellow-gray silt loam upland timber soil covers 16.13 per cent. "The most significant facts revealed by the investigation of the Winnebago County soils are the lack of limestone and the low content of phosphorus, or nitrogen, or both, in the most common prairie and timber types."

Soil survey of Webster County, Iowa, J. O. VEATCH and F. B. HOWE (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 44, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station and issued June 1, 1916, deals with the soils of an area of 456,960 acres in central Iowa, the topography of which is level to very gently undulating without marked relief. A large part of the area is imperfectly drained. "The county lies in that part of the State covered by the last great ice invasion of the Pleistocene period."

The soils are mainly of glacial origin and are prevailingly black. Including peat and muck, eleven soil types of six series are mapped, of which the Fargo loam, Carrington loam, and Fargo clay loam cover 46.6, 23, and 22.1 per cent of the area, respectively.

Soil survey of Jefferson Davis County, Mississippi, T. M. BUSHNELL and L. V. DAVIS (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 27, fig. 1, map 1*).—This survey, made in cooperation with the State of Mississippi and issued June 8, 1916, deals with the soils of an area of 259,840 acres in southern Mississippi lying entirely within the Coastal Plain. "The topography is prevailingly rolling but seldom too steep for cultivation. Drainage is well established." The upland soils comprise 84 per cent of the area. Fifteen soil types of nine series are mapped, of which the Ruston fine sandy loam covers 52.3 per cent of the area.

Soil survey of Pettis County, Missouri, H. H. KRUSEKOPF and R. F. ROGERS (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 41, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station and issued June 6, 1916, deals with the soils of an area of 432,000 acres in west-central Missouri. "In general, the topography is smooth to gently rolling, with rough areas in the limestone region in the northeastern part of the county."

The soils of the county are "silt loams, containing relatively little sand or clay. They are usually mellow or are easily made so with proper treatment. They are well drained and are moderately early and warm. The subsoils are universally heavier than the surface material which makes the various types generally retentive of moisture. As in most prairie regions, the soils originally had a high content of organic matter, but continuous cropping has reduced this to a large extent." Including rough stony land, 22 soil types of 14 series are mapped, of which the Oswego and Summit silt loams cover 24.9 and 20.8 per cent of the area respectively.

Soil survey of Chautauqua County, New York, T. M. Morrison, C. C. Engle, and G. L. Fuller (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 60, fig. 1, map 1*).—This survey, made in cooperation with the New York State College of Agriculture and issued May 22, 1916, deals with the soils of an area of 684,160 acres in southwestern New York which comprises a lake plain and rolling to hilly upland. "The soils have all been derived from glacial débris, originating largely from the sandstone and shales of the region, but with admixture of some foreign material brought in by the ice." Including muck, meadow, and rough stony land, 26 soil types of 9 series are mapped, of which the Volusia silt loam covers 58.1 per cent and the Wooster silt loam 10.2 per cent of the area.

Soil survey of Lincoln County, North Carolina, R. T. A. Burke and L. L. Brinkley (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 33, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture and issued May 19, 1916, deals with the soils of a well-drained area of 195,200 acres in the Piedmont Plateau section in southwestern North Carolina, the surface of which ranges from almost level or gently rolling to rolling or broken. The soils are of residual and alluvial origin. Eleven soil types of 5 series are mapped, of which the Cecil clay loam and fine sandy loam cover 42.8 and 12.9 per cent of the area, respectively, and the Louisa gravelly loam and Cecil sandy loam 12.3 and 11.7 per cent, respectively.

The availability of nutrient salts, A. G. McCall (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, pp. 47–50*).—A comparison of the results of winter wheat cultures in sand, receiving a nutritive solution and the osmotic concentration of which was 1.75 atmospheres, with those obtained in 3 salt nutritive solution cultures led to the conclusions "(1) that the concentration of the nonadsorbed solution in the sand is markedly lower than that of the solution which was added, (2) that the adsorbed salts are either nonavailable or are very greatly retarded in their participation in the growth process of the plant, and (3) that for this particular concentration the ratio of magnesium to calcium ions in the optimum nutritive solution is materially changed by the adsorption process."

The action of chlorids on soil and plant, E. Haselhoff (*Fühling's Landw. Ztg., 64 (1915), No. 19–20, pp. 478–508*).—The author reviews work by himself and others on the influence of chlorids, especially sodium and magnesium chlorids, on seed germination, growing plants, the physical and chemical composition of soil, and the productiveness of soil.

It is concluded that plant growth may be inhibited by a solution of 5 gm. of sodium chlorid to 1 liter of water and that the solution is injurious in a concentration as low as 0.5 gm. per liter of water. Owing to the variable influence of different types and composition of soil and plant and of climate, it is thought that no general limiting concentrations can be specified. Similar conclusions are drawn with reference to the influence of magnesium chlorid solutions on plant growth, except that it is thought the permissible concentration may be higher than that of sodium chlorid.

It is further concluded that sodium and magnesium chlorid solutions have practically the same influence on the chemical composition of the soil as do calcium and potassium chlorids, in that the soil absorbs the base of the chlorid so that in the case of magnesium chlorid an injurious excess of magnesia may gradually accumulate in the soil. The injurious influence of chlorids on the physical composition of soil is considered to be especially marked on heavy loam and clay soils and more on meadow than on cultivated soil. No limiting concentrations of chlorid solutions for this purpose can be given.

While results with reference to soil productiveness do not in all cases agree, it is considered evident that the injurious action of chlorid solutions on soil productiveness and on crop yield takes place gradually.

Circulation of manganese in natural waters, V. VINCENT (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 7, pp. 259–261; abs. in Rev. Sci. [Paris], 54 (1916), I, No. 5, p. 158*).—Experiments with soil water from natural soils and soils treated with mineral fertilizers are reported, the results of which are taken to indicate that manganese is dissolved in the presence of carbon dioxid and that a bicarbonate analogous to calcium bicarbonate is formed which exists only in solution in soil water. The formula for this is given as $MnH_2(CO_3)_2$.

It was found that natural mineralized soil waters contained more manganese than ordinary soil water, which is taken to indicate that the use of mineral fertilizers tends to increase the solubility of manganese in soils.

A comparative study of the effect of cumarin and vanillin on wheat grown in soil, sand, and water cultures, J. DAVIDSON (*Jour. Amer. Soc. Agron., 7 (1915), Nos. 4, pp. 145–158; 5, pp. 221–238*).—The results of work by others bearing on the subject are reviewed and analyzed. Pot experiments conducted at Cornell University are reported, the purpose of which was to determine the effect of cumarin and vanillin on wheat in clay loam soil, water, and quartz.

The soil culture experiments consisted of six series, (1) without additional treatment, (2) with lime, (3) with nitrogen, (4) with phosphoric acid, (5) with potash, and (6) with a complete fertilizer. "The concentrations of 600 parts per million of cumarin and of 3,000 parts per million of vanillin, figured on the basis of the total moisture content of the soil, depressed to some extent the yield of wheat grown to maturity in pots. There are indications, however, that the effect was rather on the soil than on the plant. The addition of small quantities of soil to water cultures entirely destroyed the toxic effects of cumarin, while it did not affect the action of vanillin. . . . In quartz cultures cumarin proved to be as toxic as in water cultures, while vanillin behaved approximately the same way as in the soil. Vanillin is evidently toxic only in a liquid medium when it is applied in mass, but not when it is distributed as films over quartz grains or soil particles. The ameliorating effect of phosphoric acid on the action of cumarin (E. S. R., 26, p. 224) would not seem to be due to its antagonistic behavior with reference to that toxin, since it did not behave in the same way in a balanced solution. . . . The behavior of toxic substances is so different in the soil than in water cultures, that one is hardly justified in drawing conclusions from results obtained with water cultures as to what might take place under actual field conditions."

Nitrification, E. R. ALLEN (*Mo. Bul. Ohio Sta., 1 (1916), No. 5, pp. 153, 154*).—In a brief review of the relations of nitrification in soils to crop production, it is stated that in studies made on plats of the station there appeared to be a very close relation between crop production and nitrification in samples taken from continuous culture plats. "In those taken from the barnyard manure series in the three-year rotation consisting of corn, wheat, and clover there was no consistent relation. The results in the one case were just as striking as in the other. This indicates that the factors which limit crop production in the continuous culture plats are not the same as those which exert a controlling influence in the barnyard manure series."

Recent investigations on the production of plant food in the soil, II, E. J. RUSSELL (*Jour. Roy. Hort. Soc., 41 (1915), No. 2, pp. 188–199, figs. 5*).—This article deals further (E. S. R., 35, p. 322) with the decomposition of plant residues in the soil as influenced by natural changes indicated by the rate of

oxygen absorption or carbon dioxid production, the rate of ammonification or nitrification, and the changes in bacterial numbers in the soil.

It is pointed out that, as a general rule, soil organisms are dependent upon suitable temperature and water supply, and that they must have food and, in many cases, calcium carbonate, but that "soil bacteria are subject to the operation of some limiting factor quite distinct from temperature, moisture content or food supply." Curves for carbon dioxid and nitrate determination showed a marked similarity except that the increases in nitrate came later, indicating "that the curves both for nitrate and carbon dioxid are in the main production curves."

The author disagrees with the bacterio-toxin theory as developed from laboratory cultures, but produces some evidence showing that the growing plant exerts a depressing effect on soil organisms.

Th 1espective values of organic and inorganic manures, H. E. P. Hodsoll (*Jour. Roy. Hort. Soc., 41 (1915), No. 2, pp. 217–226*).—Cropping experiments with organic and inorganic manures and comparative studies of their mechanical, chemical, and biological actions in soil are reported. The results led to the conclusion that organic manures should be used as a base to supply humus and thus improve the texture of the soil, enable the obtaining of good tilth and a good seed bed, permit the gradual feeding of the crop, and provide humus to feed bacteria, and that mineral manures should be used as a top-dressing to promote rapid growth and to act as a sterilizer to keep the bacterial flora in balance.

The influence of the time and depth of plowing under of stable and green manure on yield, C. von Seelhorst (*Jour. Landw., 63 (1915), No. 3, pp. 233–260, fig. 1*).—Field experiments begun in 1905 with rotations of winter barley, beets, oats, beans, rye, potatoes, summer wheat, and peas; and rye, beets, barley, beans, rye, potatoes, barley, and peas are reported. The manures were applied in the fall and spring to beet and potatoes, the green manure being applied usually at the rate of 100 lbs, of vetch and 25 lbs. of horse beans per acre, and the stable manure in amounts equivalent to about 100 lbs. of nitrogen per acre. The depth of plowing was from 5 to 6 in., from 7 to 8 in., and 9 in.

It was found that with beets fall manuring was on the average more favorable than spring manuring. Both manures when used in the fall gave on the average practically the same results regardless of depth of plowing. Shallow plowing in of green manure in the fall gave slightly better results than deep plowing, but no difference was observed with stable manure. When plowed under in the spring green manure gave better results than stable manure when deep plowed, while better results were obtained with stable manure when shallow plowed.

Spring manuring was more favorable to potatoes than fall manuring. Stable manure gave better results than green manure in both fall and spring use, and deep plowing gave better results in both spring and fall than shallow plowing.

With barley following beets the time of manuring of the beet crop had no effect on the barley crop. Shallow plowing under of the manures for beets gave better results for barley in both spring and fall. The after-effect of green manuring in both spring and fall was less than that of stable manure. With barley following potatoes, fall manuring with both manures gave somewhat better results than spring manuring. Deep plowing with one exception gave better results than shallow plowing. The barley crop following potatoes was always somewhat greater than the barley crop following beets.

Spring manuring of potatoes had a somewhat better after-effect on peas than fall manuring. Deep plowing in of both manures for potatoes had a better effect in spring and a poorer effect in fall on the following pea crop than shallow plowing. The after-effect of stable manure was greater for peas than that of green manure. Spring manuring of beets had a better effect on the following bean crop than fall manuring, and deep plowing was better than shallow plowing. Stable manure had a better after-effect on beans than green manure.

Spring manuring of potatoes had a better effect on the rye crop following peas than did fall manuring. Stable manure in this case had a better after-effect than green manure for rye as did also the deep plowing as compared to shallow plowing.

With rye following beans no difference was observed between fall and spring manuring with green manure, but with stable manure the spring manuring had the greater effect. The after-effect of stable manure on rye following beans was better than the after-effect of green manure. Deep plowing in the fall was better in this case also than shallow plowing, while by spring manuring with green manure the reverse was true. With stable manure depth of plowing had no effect.

The rôle of nitrifying bacteria in the decomposition of manure, V. G. Smirnov (*Zhur. Opytn. Agron., 16 (1915), No. 5, pp. 329–374*).—Experiments with artificial manure prepared from horse and cow excrement, sterilized and inoculated with soil nitrifying bacteria under aerobic and anaerobic conditions, are reported.

Under anaerobic conditions nitrogen losses in the form of free nitrogen were considerable from manure inoculated with nitrifying bacteria. Under aerobic conditions the nitrogen losses were small.

It is concluded that the participation of nitrifying bacteria in the decomposition of manure served to reduce the quantity of ammonia nitrogen present. Under anaerobic conditions the losses of ammonia nitrogen increased steadily. This is taken to indicate an increase of combined ammonia and a decrease of free ammonia. As the results did not agree no general conclusions were drawn regarding the transformation of albuminous nitrogen. It was further found that the phosphoric acid content of the manure remained unchanged under both aerobic and anaerobic conditions.

With reference to the conservation of manure and the prevention of nitrogen losses, it is concluded that conditions should be such as to retard the development of nitrifying bacteria and to favor the formation of organic acids which will combine with ammonia.

Green manuring experiments, J. A. Voelcker (*Jour. Roy. Agr. Soc. England, 75 (1914), pp. 295, 296; Woburn Expt. Sta. Rpt. 1914, pp. 12, 13; abs. in Jour. Bd. Agr.* [*London*], *22 (1915), No. 4, p. 353*).—It was found in these experiments that rape was the best green manure for wheat, with mustard second, while the crop after tares was the smallest of the three.

The activity and availability of insoluble nitrogen in fertilizers as shown by chemical and vegetation tests, F. R. Pember and B. L. Hartwell (*Jour. Indus. and Engin. Chem., 8 (1916), No. 3, pp. 246–251, figs. 2*).—Pot culture experiments conducted at the Rhode Island Experiment Station with oats, rye, and millet to determine the availability of the nitrogen of dried blood, tankage, castor pomace, rape meal, sodium nitrate, calcium nitrate, cyanamid, and a number of other nitrogenous fertilizers are reported, together with laboratory tests of the activity of the water-insoluble nitrogen in these fertilizers by the alkaline and neutral permanganate methods.

It was found that "rye and oat plants grown during late fall and early winter did not make as large a growth as those grown after midwinter for the same period under otherwise the same conditions, but the amount of nitrogen removed in the tops of the plants was much the same in both experiments. Although the rye plants did not make as large a growth as the oat plants, the relative growth was much the same with those having like treatment.

"Plants having their nitrogen added in the form of garbage tankage or aluminum nitrid made no larger growth than those to which no nitrogen was added. Nitrogen in water-extracted blood proved just as available to the oat plant as that in the unwashed blood. Plants securing their water-insoluble nitrogen in animal tankage made fully as large a growth as those receiving it in blood. The water-insoluble nitrogen in castor pomace and rape meal proved excellent sources of nitrogen for the growth of oat plants, while Kanona tankage proved to be quite an inferior source of nitrogen. An application of 0.6 gm. nitrogen in cyanamid (165 lbs. of nitrogen per acre) proved toxic to the young plants but they were able to overcome the toxicity and make a fair growth. . . .

"The nitrogen in soot had an availability of 56 compared with that in blood at 80. Nitrogen in oxamid produced plant growth about equal to the average produced by that in blood and in nitrate of soda.

"Lower activities secured by modifications of the neutral permanganate method in general agreed no better with the availabilities than those secured by the unmodified method. Of the 56 fertilizers tested, not only by the oat plant but also by the alkaline and neutral permanganate methods, 24 were found to contain water-insoluble nitrogen having an availability of less than 45 as compared with blood nitrogen at 80. Of these, 13 were actually classed as inferior by having an activity of less than 55 by the alkaline permanganate method, and three more were practically so classed, their activities being only one to two points higher. Two having availabilities of only 54 and 50 were condemned by activities of 51 and 41. None was condemned by the alkaline method which proved to have a high availability. The neutral method, on the basis of activities of less than 80, detected 19 of the 24 inferior ones and three more having availabilities of only 54, 50, and 49, but condemned three with the satisfactory availabilities of 81, 74, and 68. . . .

"About the same percentage of the inferior samples was detected by the two methods, but the neutral method condemned some samples which proved to have satisfactory availabilities according to the vegetation tests. The percentage of the insoluble nitrogen attacked by the potassium permanganate solution agrees much closer with the relative availability by vegetation test, in case of the alkaline than of the neutral method."

Field experiments on the action of new forms of nitrogen, SCHNEIDEWIND (*Mitt. Deut. Landw. Gesell., 31 (1916), No. 2, pp. 16–20*).—Field experiments are reported with potatoes on dry sand soil; with potatoes, beets, and rye on damp sand soil; and with sugar beets, oats, winter rye, and summer wheat on humus loess loam soil to compare the fertilizing action of sodium, calcium, ammonium, and urea nitrates; ammonium chlorid and sulphate; urea; and lime nitrogen when added in amounts equivalent to 0.3, 0.45, and 0.6 kg. of nitrogen per 100 square meters.

The results indicate that ammonium chlorid, ammonium nitrate, urea, and urea nitrate were equal in fertilizing action to ammonium sulphate, and the last three in some cases were equal to sodium nitrate. Ammonium nitrate, however, has the disadvantage of being very hygroscopic and explosive. The average fertilizing action of lime nitrogen was somewhat less than that of the other fertilizers. The two types of calcium nitrate were equal in fertilizing

action to sodium nitrate, although the latter is deemed generally preferable as it is more easily stored and used.

The industry and commerce of nitrogenous substances, A. BERTRAND (*Asoc. Sal. Propaganda Bol. 8 (1915), Sup., pp. XV+155*).—This report deals with the sodium nitrate, ammonium sulphate, synthetic nitric acid, cyanamid, synthetic ammonia, and aluminum nitrid industries, with the different processes of manufacture involved in these industries, and with their relative commercial standing.

Experiments with phosphatic manures on green crops (*Indian Tea Assoc., Sci. Dept. Quart. Jour., No. 4 (1915), pp. 94–99*).—Plat experiments with a number of green crops, including white and brown cowpeas, on an acid soil deficient in phosphoric acid, to determine the relative fertilizing value of a so-called basic phosphate, degelatinized bones, superphosphate, and basic slag showed that in their order the phosphorus fertilizers produced increases in crop yield of 38, 164, 273, and 273 per cent. The basic phosphate was very slow in action and is considered unsuitable for growing green crops on this soil. The bone fertilizer gave rapid results, but was expensive, and its immediate effect for the same price did not compare well with that of superphosphate and basic slag. In the absence of phosphoric acid no increase in crop was obtained from the use of nitrogenous and potassic manures.

A table showing the relative costs of the fertilizers for equal efficiencies is also included.

The solubility of different phosphates and their utilization by oats and buckwheat, T. PFEIFFER, W. SIMMERMACHER, and W. RATHMANN (*Landw. Vers. Stat., 87 (1915), No. 2–3, pp. 191–214*).—Pot-culture experiments with oats and buckwheat and laboratory experiments with dicalcium and tricalcium phosphates and a coral rock phosphate are reported, the purpose of which was to determine the availability of the phosphoric acid of the phosphates to the crops and the relation of its availability to its solubility in water saturated with carbon dioxid. The dicalcium phosphate contained 50.65 per cent phosphoric acid, the tricalcium phosphate 40.75 per cent, and the coral phosphate 39.82 per cent. The last-named phosphate contained 10.78 per cent phosphoric acid soluble in 2 per cent citric acid.

It was found that the solubility of the phosphates as indicated by water saturated with carbon dioxid did not always correspond with the availability of the phosphoric acid as indicated by the cropping experiments. The buckwheat was better able to assimilate phosphoric acid from difficultly soluble phosphates than was oats, this being attributed to the content of organic acids in the root sap.

Experiments on the action of the phosphoric acid in different Thomas meals, TACKE, GERLACH, SCHNEIDEWIND, HASELHOFF, and EBERHART (*Landw. Vers. Stat., 87 (1915), No. 2–3, pp. 89–95, pls. 6*).—Reports from five German experiment stations of cropping experiments with 19 different types of Thomas meal are reported, the purpose of which was to determine the relation between the availability of the phosphoric acid in the different meals as indicated by cropping experiments and the availability as determined by the 2 per cent citric-acid method. It is concluded that there is no ground for rejecting the method employing ammonium citrate solution containing 1.4 per cent free citric acid for determining the availability of the phosphoric acid of Thomas meal.

Phosphates and phosphatic marls (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 1, pp. 152–159*).—This section of the report contains the results of analyses of 31 samples of Florida phosphates and phosphatic marls.

Idaho phosphate resources, R. N. BELL (*Jour. Electricity, 36 (1916), No. 13, pp. 243–246*).—The details of the fertilizer resources of Idaho and Montana are discussed with special reference to extensive beds of what is considered high-grade rock phosphate in Idaho.

Investigation of a reported discovery of phosphate in Alberta, H. S. DE SCHMID (*Canada Dept. Mines, Mines Branch Bul. 12 (1916), pp. IV+38, pls. 13, fig. 1*).—This report deals with the geology, general characteristics, and extent of a phosphate bed near Banff, Alberta.

It was found that the deposit possesses an average thickness of about 12 in. and contains an average of about 43.7 per cent of tricalcium phosphate and 43.3 per cent of insoluble matter, chiefly silica. From the data obtained it is assumed that there are 10 square miles of beds, or 26,137,600 short tons, of phosphate rock. "There are at least two outcrops of the phosphate bed that are conveniently situated as regards accessibility and transportation facilities, the one being about 4 miles from Banff station and the other hardly more than a mile from the railroad. While unsuited to the manufacture of superphosphate by the sulphuric-acid method, owing to the low content of tricalcic phosphate . . . and to the large amount of silica present . . . the Alberta rock would possibly prove suitable for treatment by one of the thermic processes that have lately been proposed to supplant the sulphuric-acid method."

Recent progress of mineralogy in relation to soils: The investigation of potash and phosphate beds, B. GOSSNER (*Forstw. Centbl., n. ser., 38 (1916), Nos. 1, pp. 1–18; 2, pp. 77–84, figs. 6*).—This article deals briefly with the mineralogy and geology of the principal known deposits of phosphates and potash salts in the world. A list of nine references to literature bearing on the subject is included.

Conservation of potassium, J. W. AMES (*Mo. Bul. Ohio Sta., 1 (1916), No. 5, pp. 155–158*).—This article deals with the liberation of the potassium of the soil by the use of fertilizers, lime, and organic matter, and reports the results of analyses made at the station of crop residues and solid and liquid manure with special reference to potash content.

Lime as a soil improver, H. J. DANNFELT (*K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 1, pp. 43–57*).—This is a discussion of the beneficial influences of lime on the physical and chemical properties of soils, attention being drawn, however, to its injurious action, in excessive amounts, on soil bacteria.

Injury to plant growth by caustic lime, ROTHERT (*Jour. Landw., 63 (1915), No. 3, pp. 227–232*).—Pot experiments with barley on mild loam soil and a red sand, to determine the limits within which caustic lime may be used on heavy and light soils without injury to plant growth and the influence of caustic lime on nitrate formation in these soils, are reported.

Caustic lime was added to the loam soil in amounts of 0.25, 0.5, and 0.75 per cent and to sand in amounts of 0.05, 0.1, and 0.25 per cent. The growth of barley plants on the loam soil was retarded from the beginning with the largest lime addition, and after a short time with the medium lime addition. In the sand cultures no difference in plant growth was observed in the beginning between limed and unlimed soil. The crop yield in the loam soil was greatly reduced by liming, being smaller the greater the amount of lime added, but in sand was favorably influenced, this being more marked with the smaller amounts of lime added. Liming increased nitrate formation in both sand and loam soils, this usually being greater with the smaller lime additions.

These results are taken to indicate that excessive liming of light sand soils may be injurious owing to the increase and loss of nitrates and the

decrease of humus content, but that this is not so likely to occur in heavier soils.

The sensitiveness of different lupines and other plants to lime, L. Hiltner (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 13 (1915), No. 5, pp. 53–59, fig. 1*).—The author reviews experiments by himself and others, the results of which are taken to indicate that lime chlorosis of lupines and the chlorotic appearances of other kinds of plants which are attributed to an excess of lime in the soil may be obviated by spraying with solutions of iron salts. It is concluded that the sensitiveness of lupines to lime is due to the injurious action of the lime on the nodule bacteria.

Magnesia and plant growth, B. C. Aston (*Jour. Agr. [New Zeal.], 11 (1915), No. 6, pp. 493–502, figs. 3*).—The work of others bearing on the subject is briefly reviewed, and the rather general results of pot and field experiments on New Zealand soils containing an injurious excess of magnesia are reported.

The results are taken to indicate that "if in a soil the amount of magnesia exceeds that of the lime, judged by means of a strong solution of hydrochloric acid, and such excess be deemed to be injurious, a great number of New Zealand soils, according to analytical records, stand in immediate need of some form of lime from this cause alone. . . . If the excess be judged by a weak acid solution, the number of known soils with an injurious amount of magnesium in them becomes narrowed down to a few localities in the Nelson Province. . . . As to the remedy for excessive magnesia in the soil. . . . in extreme cases land plaster (gypsum or sulphate of lime) or larger dressings of ground limestone (carbonate of lime) should be applied."

[Trials with bacterized peat and magnesium sulphate], J. Dunlop (*Midland Agr. and Dairy Col., Rpt. Field Trials Col. Farms, 1915, pp. 53–55*).—Tests of bacterized peat used on wheat, hay, and potatoes at the rate of 700 lbs. per acre and of manganese sulphate used on potatoes at the rate of 25 lbs. per acre gave negative results. "Apparently, therefore, little or no help is to be got from either 'humogen' or sulphate of manganese in increasing food production."

[Fertilizer analyses], R. E. Rose and F. T. Wilson (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 1, pp. 53–93*).—This section of the report contains actual and guarantied analyses of 422 samples of fertilizers and fertilizing materials offered for sale in Florida during 1915.

Commercial fertilizers: What they contain and their uses, W H. Stroud (*Wisconsin Sta. Bul. 265 (1916), pp. 11, fig. 1*).—This bulletin discusses the composition, valuation, and use of commercial fertilizers, reports the results of actual and guarantied analyses of 35 samples of licensed fertilizers and fertilizing materials and analyses of 12 samples of unlicensed fertilizers and ground limestone offered for sale in Wisconsin during 1915, and summarizes the State fertilizer law.

Miscellaneous samples, limestones, marls, shells, L. Heimburger (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 1, pp. 159–167*).—This section of the report contains the results of analyses of 47 miscellaneous samples of Florida limestones, marls, and shells.

AGRICULTURAL BOTANY.

Pfeffer jubilee volume (*Jahrb. Wiss. Bot. [Pringsheim], 56 (1915), Pfeffer-Festschr., pp. XVI+832, pls. 11, figs. 64*).—This volume, in honor of Wilhelm Pfeffer, commemorates the fiftieth anniversary of his doctorate and the seventieth of his birth. In addition to the articles noted elsewhere in this issue, it contains the following contributions: The Influence of Centrifugal Force on

Plants, by F. M. Andrews; *Thiospirillum jenense* and its Reaction to Light Stimulus, by J. Buder; Spore Generation and Release by *Coprinus sterquilinus*, by A. H. R. Buller; The Distribution of Certain Liverworts of the Malay Region, by D. H. Campbell; Physiological Fragments from a Tropical Forest, by F. C. von Faber; Anatomical and Physiological Studies on the Flowers of the Orchid Genera Catasetum and Cycnoches, by H. R. von Guttenberg; Gas Exchange in the Marine Algæ, by R. Harder; Disorganization of the Tapetum Cells in Pollen Sacs of Angiosperms, by H. O. Juel; Growth and Rest of Tropical Trees, by G. Klebs; Nutritive Physiology of Extreme Atmospheric Epiphytes, by R. Lieske; Problems Regarding the Twining of Plants, by H. Miehe; Studies on Prothallia of Ferns with Regard to Imbedded Antheridia and Apogamy, by D. M. Mottier; The Behavior of Twining Plants in Darkness, by F. C. Newcombe; A Multiple Clinostat, by G. Peirce; and Laws Regarding the Compensation Relations of Parallel and Opposed Light and Mass Impulse, by A. Sperlich.

A convenient modification of the porometer, R. C. KNIGHT (*New Phytol., 14 (1915), No. 6–7, pp. 212–216, fig. 1*).—The author describes a form of porometer which he has devised, with a typical experiment illustrating its use. Some advantages are claimed for this form over that used by Darwin and Pertz (E. S. R., 27, p. 222).

On the use of the porometer in stomatal investigation, R. C. KNIGHT (*Ann. Bot. [London], 30 (1916), No. 117, pp. 57–76, figs. 7*).—This is an account of preliminary experiments carried out looking to discovery of possible sources of error in work done with the porometer above mentioned. These include temporary deformations of the leaf due to pressure differences, the tendency of stomata to close when air is drawn continuously through them, the temporary tendency to close after rough handling, and the disproportionately great resistance offered by intercellular spaces. In the plants investigated there was a considerable similarity in the behavior of the stomata of different leaves, but still more in that of those of the same leaf. Stomata of a mature healthy leaf may open more widely than those of either a very young or very old leaf.

A description of a recording porometer and a note on stomatal behavior during wilting, C. G. P. LAIDLAW and R. C. KNIGHT (*Ann. Bot [London], 30 (1916), No. 117, pp. 47–56, figs. 3*).—The apparatus here described is essentially a continuously acting, self-recording modification of the porometer briefly described in the paper noted above. A constant-pressure aspirator is employed to draw air through the leaf, and the speed of the air stream (inferentially also the relative size of the stomatal apertures) is measured by the rate of flow. The results obtained are said to be very satisfactory, and to show close agreement with the observation of Darwin and Pertz that in case of a leaf detached from the plant the stomata opened temporarily before their final closure, the phenomenon being ascribed to wilting.

The gas exchanges of water plants, H. KNIEP (*Jahrb. Wiss. Bot. [Pringsheim], 56 (1915), Pfeffer-Festchr., pp. 460–510*).—This is a contribution on the method of bubble counting, and the several sections deal with the oxygen content of the bubbles as related to the rapidity of their formation, the effect of water movement on bubble production, the interruption of bubble production by interruptions of the light supply, and a new method of ascertaining the minimum light intensity required for assimilation.

Synthetic processes in plants, II, P. BOYSEN-JENSEN (*Jahrb. Wiss. Bot. [Pringsheim], 56 (1915), Pfeffer-Festschr., pp. 431–446*).—Continuing earlier work (E. S. R., 28, p. 127), the experiments described are claimed to have shown that two stages may be distinguished in the germination of peas. In the first of these cane sugar is utilized, partly for growth, partly for respiration. Separated cotyledons show a decrease of cane sugar. In the second stage the

same material is present in the cotyledons as the transferable form of starch. The concentration of cane sugar is greater in the cotyledons than in the embryo and increases in the former when they are separated, decreasing in the latter under that condition. The cotyledons contain only small proportions of reducing sugar.

The mode of formation of cane sugar is not indicated by the results obtained in these experiments. The formation of cane sugar from maltose is considered improbable, but it is thought that starch may be hydrolyzed to monosaccharids, and that this material may then form saccharose. It is considered probable that both monosaccharids and disaccharids may appear as translocable forms of starch.

Some experiments on the influence of temperature on the rate of growth in Pisum sativum, I. LEITCH (*Ann. Bot.* [*London*], *30* (*1916*), *No. 117, pp. 25–46, pl. 1, figs. 10*).—In experiments with *P. sativum* the author has found that the relation of growth to temperature can be expressed by a uniform curve from —2 to 29° C. Above this point the relation can no longer be expressed as a curve, each higher temperature requiring a different curve to show the rate of growth in successive intervals of time. Between 30 and 40° these are not simple time curves. A well-marked optimum appears to lie between 28 and 30°, and the maximum rate temperature appears to be 30.3°. A bibliography is appended.

Sap ascent, E. B. COPELAND (*Jahrb. Wiss. Bot.* [*Pringsheim*], *56* (*1915*), *Pfeffer-Festschr., pp. 447–459, fig. 1*).—Reviewing the literature of the forces concerned in the elevation of sap in plants, the author describes experiments carried out, claiming that living cells are not essential to the ascent of water in stems and that differences in pressure of water columns in plant stems do not necessarily correspond to differences in pressure in tubes containing water colums of the same height.

The cohesion theory of water movement, O. RENNER (*Jahrb. Wiss. Bot.* [*Pringsheim*], *56* (*1915*), *Pfeffer-Festschr., pp. 617–667, pl. 1, figs. 4; abs. in Naturwissenschaften, 3* (*1915*), *No. 10, p. 136*).—The author has studied the forces and resistances concerned with water movement in plants, more particularly as noted in connection with deformation of the annulus in fern sporangia. Evidence was obtained in the study of water in the cells of the annulus of a degree of tension amounting in extreme cases to 350 atmospheres.

Cohesion and osmosis, C. STEINBRINCK (*Ber. Deut. Bot. Gesell., 33* (*1915*), *No. 8, pp. 451–460*).—This is a review of several contributions bearing upon questions of cohesion and osmosis, giving more particular attention to recent work by Renner as above noted.

The cohesion of water in the annulus of the sporangium in ferns, A. URSPRUNG (*Ber. Deut. Bot. Gesell., 33* (*1915*), *No. 3, pp. 153–162, figs. 2*).—The author claims to have found that distilled water in the cells of the sporangial annulus in ferns developed a tension of about 300 atmospheres.

Views of biological adsorption phenomena, F. CZAPEK (*Jahrb. Wiss. Bot.* [*Pringsheim*], *56* (*1915*), *Pfeffer-Festschr., pp. 84–111*).—This is a review of some investigations and opinions since 1803 regarding adsorption and related phenomena, dealing somewhat particularly with the more recent developments concerning phenomena of the colloidal state and cell behavior in connection therewith.

Studies on the entrance of salts into living cells, H. FITTING (*Jahrb. Wiss. Bot.* [*Pringsheim*], *56* (*1915*), *Pfeffer-Festschr., pp. 1–64, figs. 3*).—The several divisions of this report deal with the method involved, the rapidity of entrance of potassium nitrate into the cell, the association of this salt with a decrease of permeability to water, the causation of alterations in permeability for this

salt, the permeability relations of other salts, and a discussion of the facts observed.

In leaves of *Rhœo discolor*, plasmolysis was rapid, reaching its maximum in about 15 minutes, and then showing a reversal. Preliminary experiments with other objects are said to indicate that the influence of salts on the permeability of plasma may prove to be more widely prevalent than it is now known to be. No support was found for the view that decrease of permeability is referable to injury of the protoplasm. These experiments are considered to throw light on the nonreversal of plasmolysis as sometimes observed, also to show that the inflow of salts does not necessarily proceed as far as equilibrium of the internal and the external solutions. They are said also not to support the lipoid theory regarding the uptake of nutrient materials.

A bibliography is appended.

Absorption of ions by plants, E. PANTANELLI (*Jahrb. Wiss. Bot. [Pringsheim], 56 (1915), Pfeffer-Festschr., pp. 689–733*).—The author reports investigations bearing upon the questions of the dependence between uptake of cations and that of anions, changes in chemical reaction of the medium external to the plant following ionization, antagonistic influences of ions as affecting uptake, influence of concentration, curves of uptake, and mechanics of salt absorption.

It is stated that the uptake of a salt by living plasma is a phenomenon of adsorption. Ions of salts are absorbed separately and not in salt molecules as wholes, cation and anion being generally absorbed in different proportions. Ion adsorption is independent of water adsorption. Its rapidity differs with the nature of the ions involved and with time, but not uniformly. Above a certain concentration, all ions lead to an increase of specific permeability, thus opening up a new field to adsorption. Evidence has been obtained of the separateness of extrapermeability and intrapermeability in this connection. Slight narcosis decreases uptake of most, but not all, ions. Apparently, undetermined physiological factors are operative. Slight narcosis may oppose uptake of nutritive ions and may favor that of injurious ones.

A bibliography is appended.

Concerning the comparative rapidity of absorption of anions and cations by plants, E. BOBKO and E. N. SINSKAÎÂ (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), 9 (1913), pp. 448–455*).—Barley, lupine, and pumpkin were grown in the presence of potassium, ammonium, magnesium, and calcium sulphates. In another test barley alone was grown with potassium, sodium, ammonium, and calcium chlorids.

With sulphates it was definitely found that the ions are absorbed independently, although no such pronounced deviation from the original ratio as reported by Pantanelli was observed between the absorption of the cation and the anion. The same experiment showed that there is a connection between the absorption of certain ions and changes in alkalinity, but no explanation of this phenomenon is advanced. With chlorids, absorption of anions by barley prevailed over absorption of cations in all cases except that of ammonium chlorid.

On the question of the equivalent absorption of anions and cations by plants, G. I. RITMAN (RITTMAN) (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), 9 (1913), pp. 505–513*).—These experiments were carried out with peas to determine the relative intensity of absorption of the anions and cations of calcium salts. The plants were grown in the dark as well as in the light and examined at various stages of development.

It was found that in all cases, the anions and the cations of the chlorids and the sulphates were absorbed at the same rate, but with a tendency to a

somewhat greater assimilation of the calcium On the other hand, the anions of the nitrates and the phosphates were absorbed in considerably larger amounts than the calcium ions. The difference in the amount of absorbed anions and cations in these cases was so large that in no way could it be accounted for as a possible experimental error.

Effect of osmotic pressure in nutrient solutions on plant growth, A. A. STOL'GANE (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *9* (*1913*), *pp. 514–550, pl. 1*).—The object of the author's experiments was to determine the effect of the osmotic pressure in nutrient solutions on the general development of plants and on their absorption of nitrogen. Flax and barley were grown in sand and water cultures to which various combinations of nutrient solutions were added containing ammonium nitrate as well as sodium chlorid, potassium chlorid, magnesium sulphate, potassium sulphate, and sodium sulphate.

It was found that the plants can resist only a comparatively low osmotic pressure, which, however, when not exceeding two atmospheres, as was the case with sodium chlorid, has even a stimulating effect upon the growth. Growth was retarded by increased osmotic pressure and all the vegetative processes may be checked entirely if the pressure becomes much higher than two atmospheres. The percentage of nitrogen increased with increase of pressure, but its total amount as shown in the yield was diminished except in those cases where the osmotic pressure was comparatively low.

Stimulants of plant growth, F. V. CHIRIKOV (T. TSCHIRIKOW) (*Iz Resul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *9* (*1913*), *pp. 431–435*).—This work is a continuation of experiments of the previous year, potassium permanganate, manganese chlorid, molybdic acid, sodium tungstate, uranium nitrate, and iron sulphate being tested as stimulants of plant growth with Persian wheat, Swedish wheat, buckwheat, and peas grown in sand cultures.

With wheat it was found that all the stimulants gave more or less positive results, while with the other plants the results were variable. When two stimulants were present together in the same culture, their combined effect represented very closely the aggregate action of the two chemicals taken separately. Uranium nitrate and sodium tungstate increased the quantity of seeds in peas. The largest general increase of yield for wheat was obtained with manganese chlorid, and for peas with uranium nitrate.

The metabolism of nitrogenous substances in etiolated shoots of barley nourished on ammonium salts, A. I. SMIRNOV (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *9* (*1913*), *pp. 470–504*).—Experiments carried out with carbamid, ammonium nitrate, and ammonium chlorid, the ammonium nitrate and chlorid being used with and without the addition of calcium carbonate and calcium sulphate, demonstrated that seedlings of barley absorb the nitrogen of the ammonium salts very energetically during the first days of growth, showing also an increased activity in the formation of asparagin. Later on the rate of absorption gradually decreased, but this was not found to be due to the lessening of osmotic pressure in the solutions.

Calcium salts influenced the assimilation of nitrogen from ammonium salts and stimulated the formation of asparagin, as well as the splitting of proteins. The nitrogen of the nitrates was absorbed with equal energy.

Assimilation of nitrogen from ammonium salts and accumulation of ammonium salts in the tissues were in reverse proportion. This fact is connected with the consumption of carbohydrates and is analogous to the behavior of etiolated seedlings of lupines, plants poor in carbohydrates.

Absorption of negative ions by seedlings of barley was found to take place only during the first few days of the experiment.

Concerning the relation of etiolated shoots of maize and lupine to ammonium salts and nitrates, D. N. PRIANISHNIKOV (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *9* (*1913*), *pp. 559–565*).—This is a brief account of some unpublished experiments conducted at the Moscow Agricultural Institute of Russia by the late S. I. Kalinkin.

These experiments show that ammonium salts as well as nitrates serve as a source of nitrogen in etiolated maize plants. However, more nitrogen is absorbed from ammonium salts than from nitrates, and, as regards the latter, calcium nitrate appears to be a better source of nitrogen than sodium nitrate. With lupines, ammonium chlorid caused a loss of nitrogen, a lower asparagin content, and a higher ammonium content. Nitrates did not bring about so great an absorption of nitrogen or formation of proteins in lupines as in maize.

Stereochemistry and the biological action of ammonium compounds, F. PLATE (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 23* (*1914*), *II, No. 7, pp. 292–296*).—The author thinks that the diverse action of the chlorid and the nitrate of ammonia, as shown by the behavior of plants in nutritive solutions, is due to differences in the stereochemistry of these compounds, which are discussed.

The action of ammonium compounds on Avena sativa, F. PLATE (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 24* (*1915*), *I, No. 2, pp. 146–148*).—The author takes occasion to point out and correct certain typographical errors said to have passed undetected in the contribution above noted and to indicate the methods employed in the further study of this subject as now in progress.

The direct assimilation of atmospheric nitrogen by plants, EVA MAMELI and G. POLLACCI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24* (*1915*), *I, No. 9, pp. 966–971*).—This is mainly a discussion of reports and views of the authors (E. S. R., 25, p. 633; 31, p. 223) and of others noting some probable causes of error or insufficiency in work on this subject.

The question of absorption and utilization of chlorids by plants, A. S. KABLUKOV (*Iz Rezul't. Veget. Opytov Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *9* (*1913*), *pp. 551–558*).—In these experiments lupine and barley seedlings were transferred to solutions of magnesium, calcium, ammonium, and potassium chlorids. The anion was absorbed in a much larger amount than the cation only in the case of barley grown with sodium chlorid. In all the remaining cases the absorption of the anions and cations was practically equivalent.

Magnesium in chlorotic or discolored plants, EVA MAMELI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24* (*1915*), *I, No. 3, pp. 262–267*).—Comparative analysis is said to show a smaller percentage of magnesium in chlorotic or discolored leaves or leaf parts than in normal portions of the same plant. Willstätter's studies in this connection, previously noted by the author (E. S. R., 29, p. 323), are again discussed.

The influence of phosphorus and magnesium on chlorophyll formation, EVA MAMELI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24* (*1915*), *I, No. 7, pp. 755–760*).—This is largely a review of the work and views of various investigators on this subject as bearing upon the work of the author, noted above or set forth in the present report, which is made on studies carried out with *Zea mays* and *Polygonum fagopyrum* in a nutritive solution lacking magnesium. The plants were etiolated or pale green and the chloroplasts were abnormal in form as well as in color, while plants similarly treated but deprived of phosphorus were normal in these respects.

The influence of the pyrrolic acid nucleus on the formation of chlorophyll, G. POLLACCI and B. ODDO (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24* (*1915*), *II, No. 1, pp. 37–39*).—It is stated that in case of

Zea mays, germinated in a nutritive medium free from iron but containing a very small proportion of magnesium pyrrolic carbonate, the plantlets when 20 days old were well developed and normally green while the control, which lacked this magnesium compound, remained backward and showed only a very small amount of green, which was confined to the first two leaves.

The effect of the concentration of the nutrient solution on the growth of barley and wheat in water cultures, WINIFRED E. BRENCHLEY (*Ann. Bot. [London], 30 (1916), No. 117, pp. 77–90, pl. 1, figs. 4*).—It is stated that in case of barley and wheat grown in nutrient solutions under favorable conditions the concentration influences greatly the rate and total of growth even when the balance of the solution approximates a constant level. Starvation effects were noted at much higher concentrations than reported in this connection by some observers. The action of different high concentrations of constant balance has not been determined and it is considered uncertain whether there exists a distinct optimum or a range of equally beneficial concentrations.

The influence of strong Röntgen rays on the germination and growth of higher plants, M. KOERNICKE (*Jahrb. Wiss. Bot. [Pringsheim], 56 (1915), Pfeffer-Festschr., pp. 416–430, figs. 4*).—Giving an account of the effects of X-rays of varying strength on different plants, the author states that these rays parallel other rays and various bodies in solution in their biological influences, inasmuch as heavier dosage checks while lighter dosage favors the development of the plants and the activity of the process which normally take place within them.

Smoke as a means of shortening winter rest, H. MOLISCH (*Umschau, 20 (1916), No. 12, pp. 230–233, figs. 5*).—Smoke of tobacco, paper, or sawdust gave essentially the same result in hastening the resumption of activity after the winter rest period in case of several common plants exposed thereto for one or two days. The manner in which these results are produced was not discovered.

Botanical diagnosis of smoke injury in forests, F. W. NEGER (*Naturwissenschaften, 4 (1916), No. 7, pp. 85–90, figs. 4*).—Following up his previous work (E. S. R., 35, p. 243) by alleging a degree of unreliability of certain phenomena as criteria for smoke injury to forest vegetation, the author states that it is inevitable that smoke effects should resemble more or less those of drought and frost, since each results in the killing of the plasma of the assimilating cells, causing a sudden loss of water and the subsequent drying of these parts.

Anomalies in Beta vulgaris, I, II, O. MUNERATI and T. V. ZAPPAROLI (*Atti R. Acad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 4 (1915), I, Nos. 11, pp. 1150–1158, figs. 12; 12, pp. 1236–1239, figs. 3*).—This discussion of anomalies of beets includes cotyledonary leaves, fasciation, ascidiform leaf structure, neurochorisis affecting the median nerve, trumpet formation of leaves, filiform growth of leaves, cortical melanism, degeneration of roots, and other peculiarities.

Studies on the phylogeny of Nicotiana tabacum, G. E. ANASTASIA (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 11, pp. 1146–1150*).—Giving an account of studies carried out subsequently to those previously reported (E. S. R., 18, p. 635), the author holds that *N. tabacum* was originally derived from a hybridization of the two forms *N. rustica* and *N. petunioides*.

The floral biology of the peach, C. CAMPBELL (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 1, pp. 68–73, figs. 2*).—This is a discussion of the floral characters of the peach considered as being not only of biological and systematic, but also of agricultural, importance.

The floral biology of the almond, C. CAMPBELL (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 3, pp. 256–261, figs. 9*).—This is a discussion of anomalies in the floral parts of the almond, pointing to the necessity for study bearing upon the attainment of certainty and regularity in the output.

Chimeras and graft hybrids, J. BUDER (*Naturwissenschaften, 3 (1915), Nos. 1, pp. 6–9, figs. 4; 2, pp. 23–25, figs. 3; 3, pp. 33–36; abs. in Bot. Centbl., 129 (1915), No. 2, p. 20*).—The author discusses the conditions for the production of graft hybrids and the necessary relations of the cells of the symbionts to each other and to the growing point, which are described in typical forms.

FIELD CROPS.

Comparative study of the root systems and leaf areas of corn and the sorghums, E. C. MILLER (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 9, pp. 311–332, pls. 7, figs. 3*).—The methods and results of experiments conducted at the Garden City, Kans., substation of the Kansas Experiment Station, to determine the fundamental characteristics of sorghum plants enabling them to withstand severe climatic conditions better than the corn plant, are described. The data secured, together with a summary of climatic conditions, are given in tables and discussed.

In all stages of growth the primary root systems were found equally extensive, but the secondary roots of the sorghum plants as compared with those of corn were twice as numerous per unit of primary root. Both primary and secondary roots of the sorghums were found to be more fibrous than those of corn. A study of the weight of the dry matter of the aerial portions and of the roots of mature plants showed an average ratio of the dry weight of the grain, stem, and leaves of standard Kafir to the dry weight of the roots of 15:1 and 14.9:1 in 1914 and 1915, respectively, while the dry weight of the stem and leaves of the same plants was on the average 10.9 times that of the root weight in 1914, and 10.1 times the root weight in 1915. The average ratio of the dry weight of the aerial portions of dwarf milo maize to the weight of the roots was found to be 15.7:1 in 1914 and 15:1 in 1915. The weight of the stem and leaves of the same plants was 9.6 times and 8 times, respectively, the weight of the roots for the two years. The weight of the stem and leaves of Pride of Saline corn was 9.6 times the root weight in 1914 and 7.8 times the weight of the root system in 1915. The aerial parts of dwarf Blackhull Kafir corn in 1915 showed a weight of 15.7 times that of the roots, and the weight of the stem and leaves 8.9 times the weight of the roots. The results of experiments regarding soil moisture content and depth of root penetration seemed to show that under the existing conditions very little, if any, depletion of soil moisture took place below the depth of root penetration.

The leaf area of the corn plant at all stages of its growth was found to be approximately twice as great as that of Dwarf Milo maize and never less than 1.5 times that of Blackhull Kafir corn. It is pointed out that the sorghums would have the advantage over the corn plant under any climatic condition tending to bring about a loss of water from the plants. The two sorghums as compared to the corn plant have only one-half the leaf surface exposed for the evaporation of water, and also have a root system which, judging from the number of secondary roots, would be twice as efficient in the absorption of soil moisture.

Contribution to the question of spacing and feeding the individual plant in plant breeding, R. LEIDNER (*Ztschr. Pflanzenzücht., 3 (1915), No. 3, pp. 353–370*).—This article discusses the views of different authorities on plant

breeding with reference to spacing plants in experimental and practical plant breeding, giving special attention to the recommendation of Mitscherlich that each plant be given sufficient space to enable a person to walk around it and to treat it frequently with nutrient solution. The author concludes that this plan does not meet practical requirements and expresses the belief that the practical plant breeder should be advised to adhere to the customary spacing in pedigree and selection work.

Rotations and tillage methods in western Nebraska, W. P. Snyder and W. M. Osborn (*Nebraska Sta. Bul. 155 (1916), pp. 6–48, figs. 6; pop. ed. (1915), pp. 21, fig. 1*).—This bulletin is a report on plat experiments begun in 1906 at the North Platte Substation in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture for the purpose of testing various rotations, crop sequences, and methods of tillage in the production of corn, spring wheat, oats, barley, and sorghum hay. The deductions presented are based on the average results of eight years' work.

The weather conditions of the season are recognized as the greatest factor in controlling yields. The seasonal precipitation was found to have a much greater influence on the crop production than methods of seed-bed preparation, crop sequence, or the use of manure. During favorable seasons profitable crops were produced by all methods under test and during unfavorable seasons profitable crops were not produced by any method. The system of alternate cropping and summer tillage failed to overcome severe drought conditions, and was less profitable in the production of corn and spring grain than ordinary methods of production. In some unfavorable years, however, this method gave a large increase in yields over common practices.

In considering the average yearly profit or loss per acre for the eight years, it is shown that corn grown on summer-tilled land gave a loss of 3 cts. as against a profit of $3.65 for corn grown continuously. Spring wheat gave a profit of $2.11 when grown on summer-tilled land and a profit of $2.28 or $3.06 on land growing wheat continuously. Oats gave a loss of $2.29 per acre on summer-tiled land while on land continuously cropped the loss was small. Barley gave a loss of $2.08 per acre on summer-tilled land and a small profit on land continuously cropped.

The results of the eight years further indicated that from the standpoint of yield or profit it mattered but little whether the land was spring plowed or fall plowed for fall or spring grains. The difference in the yield of spring wheat on land that grew spring grain or corn the previous year was not marked during any season. Almost every year corn following corn yielded more than corn following small grain. The average annual difference for the eight years is reported at 5 bu. per acre in favor of land growing corn the preceding season. The yields of spring wheat and oats following sorghum grown for forage were not much different from the yields of the same crops following corn or spring grain. In most years spring wheat yielded more when following corn and spring grain than when following sorghum, but in some seasons the reverse was true.

The use of barnyard manure gave no appreciable beneficial effect on the yields of the succeeding crop. Rye and field peas plowed under as green manure proved to be more expensive and less profitable than alternate cropping and summer tillage. Nearly all rotations giving a loss were designed to maintain the soil fertility through barnyard manure, a green manure crop, or a grass crop. Corn grown on summer-tilled land, oats grown continuously on spring plowed or on summer-tilled land, and barley on summer-tilled land were also unprofitable. Considering the comparative ineffectiveness of barnyard manure, the most profitable rotation of the series was sorghum, corn,

and spring wheat, giving corn stover a value of $3 per ton and sorghum a value of $4 per ton.

Alfalfa and brome grass proved unsuccessful, and it is stated that for the conditions under which these crops were grown they should have been seeded in rows and cultivated. The average yearly yield of sorghum for seven years was 3.1 tons per acre. As a single crop and also in rotations corn ranked above any of the small grain crops in the profit per acre where the stover and grain are both used. Spring wheat ranked next and gave the most profit when following corn in a rotation. Barley gave less profit than spring wheat and oats were usually grown at a loss.

Carrying capacity of grazing ranges in southern Arizona, E. O. WOOTON (*U. S. Dept. Agr. Bul. 367 (1916), pp. 40, pls. 10, figs. 5*).—The plans and methods of the studies here reported, as well as earlier results secured in the work, have been previously noted (E. S. R., 23, p. 136). This bulletin summarizes the results thus far obtained including those reported in preceding publications.

Regarding the rate of recovery of the ranges it is stated that three years of complete protection gave about three-fourths of complete recovery for the area where crowfoot grama was the dominant grass at levels of about 3,500 to 4,000 ft. with an annual rainfall of from 15 to 18 in. An inclosed pasture of this type of 794 acres stocked with horses and burros at the average rate of 11 head per section recovered somewhat more slowly than the completely protected area beside it, and at the same level, but after 11 years of protection it was not and had not been for two or three years appreciably different in carrying capacity from the completely protected area. Three other areas of 1,065, 1,695, and 1,889 acres, pastured judiciously with approximately all the cattle they could carry, are reported as showing a better productivity than adjacent unprotected grazing land of the same character, and are believed to have materially increased the carrying capacity under the treatment within a period of 11 years. With complete protection the better part of this range recovered rapidly during the first two or three years and approached complete recovery in 10 or 12 years. Heavy stocking with cattle did not prevent but retarded recovery, so that after 11 years the grazed areas were but partially recovered though their carrying capacity had increased at least 30 per cent in that time.

The results of reseeding operations to introduce new species of forage plants or to increase the relative abundance of particular endemic species beyond their natural importance were practically all negative. Scattering the seeds of the best grasses of a region on the denuded areas is recommended wherever the seeds can be had in any quantity at relatively small expense.

Records were made for a series of years to work out an expression representing the average carrying capacity of the whole range reserve. From weights of the dry material collected for nine years on small measured representative areas, the total productivity in pounds of forage per acre was calculated. The yearly averages indicated the rate of improvement, and the average of all records showed an average total annual production of about 1,160 lbs. per acre. The average amount of hay obtained, as based on records covering five years on a total area of 492.5 acres, was 640 lbs. per acre. Three areas of about one acre each cut four years in succession lost in productivity from one-half to three-fourths of what they produced the first year. From the measurements of the small areas the approximate productivity of different forage plant associations was obtained, and from these figures and the areas of each association, the average production of the whole reserve was calculated

at 1,100 lbs. per acre. "Assuming the value of 1,100 lbs. per acre as an average total productivity and 50 per cent of that amount as maintenance capacity for the range, then, if the average animal eats the equivalent of 30 lbs. of dry feed per day he will need 11,000 lbs. in a year, and it will take 10 acres of land to furnish that amount at full productivity, and 20 acres of land at maintenance capacity. Thus we have an average value for carrying capacity equal to 20 acres per head per year, or 32 head per section, for the reserve."

Record was also kept of animal-days' feed consumed for a period of five years on about 16 per cent of the best part of the reserve. The average carrying capacity for 7¼ sections, or one-eighth of the whole reserve stocked with cattle was 14.1 acres per head per year. It is stated that this carrying capacity is considerably above that for the whole range. On one of the pastures stocking at the average rate of 58 acres per head per year was considerably below the limit of maintenance capacity, the pasture so stocked being not noticeably different in condition from adjacent land not pastured for 11 years.

Cereal crops in the Panhandle of Texas, J. F. Ross (*U. S. Dept. Agr., Farmers' Bul. 738 (1916), pp. 15, figs. 5*).—The topography, soil, and climate, including rainfall, humidity, wind, evaporation, and temperature are noted, and farming in the region is discussed. Brief directions are given for the culture of small grains, and the adaptability, importance, yield, quality, varieties, and rates and date of seeding each crop are taken into account. The small-grain crops considered given in the order of their importance as based on average yields are winter wheat, spring oats, winter barley, winter rye, proso, durum spring wheat, common spring wheat, winter spelt, and winter emmer. The grain sorghums, especially varieties of milo maize, Kafir corn, and feterita, are regarded as the most important grain crops for the region.

Fodder grasses of Java, X–XIII, C. A. Backer (*Teysmannia, 25 (1914), Nos. 4, pp 209–215, pls. 3; 5–6, pp. 298–317, pl. 1; 9, pp 523–549; 26 (1915), No. 1–2, pp. 86–98, pl. 1*).—These articles, which are in continuation of previous work (E. S. R., 31, p. 431), present botanical and cultural notes on *Isachne firmula*, *I. miliacea*, *I. montana*, *Panicum miliaceum*, and *Paspalum muticum*. *P. miliaceum* is discussed at some length, and in addition to its botanical characters attention is given to its culture, feeding value, and chemical composition.

Eleven years' experiments with field carrots on sandy soil at Flahult, H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 29 (1915), No. 4–5, pp. 293–317*).—Field carrots were grown on sandy soil of low fertility and drought resistance. The carrots followed rye and the soil was fertilized with manure and received in addition an application of superphosphate, potash salts, and nitrate of soda. The yields per hectare for different years were as follows: 1904, 29.9 tons; 1905, 17 tons; 1906, 42.9 tons; 1907, 17.8 tons; 1909, 43.9 tons; 1913, 39.9 tons; 1910, 50.1 tons; and 1914, 39.3 tons.

The variation in yield from year to year was mostly due to the differences in the amount of precipitation. The application of the manure in the fall gave better results than applying it in the spring. White Belgian and Champion were the most promising varieties grown.

Button clover, R. McKee (*U. S. Dept. Agr., Farmers' Bul. 730 (1916), pp. 9, figs. 3*).—This publication gives a description of button clover, enumerates the climatic, soil, and moisture requirements of the plant, points out its value for hay, pasture, and green manure, and presents directions for its culture. Tabulated data show that button clover at Chico, Cal., for the four years beginning 1908 yielded from 790 to 1,160 lbs. of seed per acre as compared with from 255 to 407 lbs. for toothed bur clover during the three years beginning 1908.

Tests were made in 1915 with seed stored for different lengths of time. Seed grown in 1912 showed a germination of 58 per cent with 2 per cent of

hard seed, and seed grown in 1907 germinated 49.5 per cent with 5 per cent of hard seed when four years old, and 29.5 per cent with 7 per cent of hard seed when seven years old. In 1911 a test made with seed grown the preceding year gave a germination of 91 per cent with 4 per cent of hard seed.

Inbreeding in maize, D. F. JONES (*Abs. in Science, n. ser., 43 (1916), No. 1104, p. 290*).—The author reports that 12 generations of continuous inbreeding in maize confirmed previous conclusions. A reduction in vegetative vigor, rapid at first but gradually slowing down and finally ceasing, was found correlative with the theoretical approach to complete homozygosity. A marked tendency was observed toward complete uniformity within the limits of physiological fluctuation. The reduction in variability was accompanied by a segregation of characters and an isolation of subvarieties differing in their power for development as expressed by the size of the plant and the yield of the grain. It is stated that after continued inbreeding there is an approach to the stability of a naturally inbred race. The constantly segregating characters in the original crossbred race are considered of little value in classification.

A Persian and other forms of emmer, A. SCHULZ (*Ber. Deut. Bot. Gesell., 33 (1915), No. 4, pp. 233–242, pl. 1*).—Different forms of emmer are discussed from a historical viewpoint and descriptions are given of some of their botanical characters, especially those of the spike, spikelets, and grains. Among the forms discussed and figured are *Triticum dicoccum farrum, T. dicoccum rufum, T. dicoccum* var. *hausskneehtianum, T. dicoccoides* var. *straussiana, T. dicoccoides* var. *kotschyana, T. dicoccum tricoccum, T. dicoccum serbicum album,* and *T. dicoccum farrum album*×*T. dicoccum serbicum album.*

Lespedeza seed, MAYME DWORAK (*La. Agr. Col., Ext. Div. Circ. 11 (1916), pp. 11*).—The results of purity and germination tests are reported, together with the results of experiments with new and old seed and with different treatments to hasten germination.

Three-year old lespedeza seed failed to germinate and two-year old seed had a very low percentage of germination. Seed with a high percentage of hard seeds in November, 1914, when tested in December, 1915, showed an increase of 11 per cent of germination and a decrease of 34 per cent in the number of hard seeds, but when tested in February, 1916, the germinative value was practically the same as in November, 1914. Corresponding samples of a high percentage of germination and a comparatively low hard seed content in November, 1914, showed practically the same percentage of viable seeds and the same hard seed content when tested in December, 1915, and February, 1916, as the samples mentioned above. Samples tested in February, 1915, had an average percentage of germination of 63.05 and an average percentage of hard seed of 16.07, but when tested a year later they showed an average percentage of germination of only 27.52 and an average percentage of hard seeds of 8.58.

The treatment of lespedeza seed with sulphuric acid, ammonium hydroxid, hydrochloric acid, and hot water, indicated that the use of hot water reduced the germinative power very perceptibly. The application of sulphuric acid so hastened germination that practically all of the viable seeds germinated within three or four days.

Investigation of the injurious effect of lime on the lupine and its prevention, B. CREYDT (*Jour. Landw., 63 (1915), No. 2, pp. 125–191, pls. 6*).—Studies of this subject by different investigators are briefly reviewed, and results are presented of experiments made to determine whether the lupine is injuriously affected by basic nutritive solutions in general or in particular by those containing lime, and if lime is the active agent whether application of potash can reduce or remove the detrimental effect. Pot experiments were

conducted in which lupines were grown on sand and clay with different lime content and treated with light and heavy applications of carbonate, bisulphate, and chlorid of potash. The data obtained are tabulated and discussed in detail.

The conclusion is reached that the injurious effects of lime on the lupine are due to a specific sensitiveness of the plant toward the substance, and are not the result of a general sensitiveness toward alkalinity. The data brought together showed that basic as compared with acid soil fertilization had the more favorable effect on the development of the plants; in fact, acid fertilization had a marked injurious influence. The author believes that this specific sensitiveness to lime is due to the solvent action of the lupine and its capacity to take up lime, and that if the lime content of the soil is high the plant makes use of these properties and takes up a large quantity of lime at the expense of the nutrients necessary for its development. It was found in these experiments that by means of applications of carbonate of potash and chlorid of potash the quantity of lime taken up can be reduced and the injurious effect to a certain extent controlled. The investigation further indicated that lime not only influenced the lupine unfavorably but that the particular nodule bacteria were also injuriously affected, suffering a reduction in their activity.

Some recent investigations in sugar beet breeding, F. J. PRITCHARD (*Abs. in Science, n. ser., 43 (1916), No. 1102, p. 219*).—Data secured in ten years' experiments in sugar beet breeding indicate that differences in the size, total sugar content, and percentage of sugar of individual beet roots show no evidence of inheritance, and that there is no correlation between percentage or quantity of sugar of roots of ordinary sizes and their yield of seed, nor between their yield of seed and the average percentage of sugar in their progeny. Discontinuance of selection for one generation caused no deterioration but some apparent gain in percentage of sugar, and no improvement was obtained in yield or percentage of sugar from continuous selection. Fluctuations in percentage and yield of sugar are regarded as due chiefly to lack of soil uniformity. Real differences between strains and varieties are thus obscured, but may be distinguished by planting each variety or family a large number of times.

Breaking the leaves of the sugar beet as a means of increasing the yield, T. REMY (*Bl. Zuckerrübenbau, 22 (1915), No. 17, pp. 189–193*).—Plats of Dippe red-crowned sugar beet and Eckendorf original field beet were planted April 22 and on August 7. The lateral leaves of the plants on two of the plats were broken near the stem, but not removed, for the purpose of observing the effect of this treatment on the yield. In comparison with the check plats the sugar beets showed a reduction in yield of 3,213 lbs. and the field beets of 7,229 lbs. per acre.

Making beet seed germination tests, H. PLAHN (*Bl. Zuckerrübenbau, 22 (1915), No. 16, pp. 177–181*).—Several methods of making beet seed germination tests are described and compared and the liability of error inherent in the different plans is pointed out.

The author describes and proposes a method based on the size of the seed bolls and their weight per hundred for which he claims greater accuracy than can be secured with the other methods discussed. The method proposed consists essentially of separating the seed sample into the different sizes of bolls by means of sieves of 2, 3, 4, and 5 mm. mesh, determining what percentage by weight each size forms of the sample, taking from each size five lots of 100 bolls each for the determination of the weight per hundred bolls,

subjecting the first, third, and fifth of these to germination tests, and averaging the results on a percentage basis.

Sugar cane experiments in the Leeward Islands, H. A. Tempany et al. (*Imp. Dept. Agr. West Indies, Sugar-cane Expts. Leeward Isl., 1914–15, pts. 1–2, pp. 76*).—These experiments included variety tests and fertilizer trials conducted in Antigua and St. Kitts in 1914–15 and in previous years. The data secured are shown graphically and in tabulated form and are briefly discussed.

In the variety tests conducted in Antigua the leading plant canes and their yields per acre were as follows: B. 6308 produced 3,560 lbs. of sucrose from 22 tons of cane per acre and B. 6450 yielded 3,100 lbs. from 19.3 tons. B. 3412 gave 2,980 lbs. of sucrose per acre and B. 3922, 2,940 lbs. In average production during the past 14 years Sealy Seedling stood first with 6,570 lbs. of sucrose per acre in the juice, B. 208 second with 6,410 lbs., and B. 156 third with 6,290 lbs. The results with ratoon canes the past 13 years placed Sealy Seedling first with 3,720 lbs. of sucrose per acre in the juice, followed by B. 156 with 3,600 lbs., and B. 306 with 3,560 lbs.

In the work with varieties in St. Kitts during the year 1914–15, D. 116 headed the list with a yield of 5,680 lbs. of sucrose per acre in the juice, being followed by B. 376 with 5,510 lbs., and Sealy Seedling with 5,450 lbs. The leading ratoon canes were B. 1753, yielding 5,300 lbs. of sucrose per acre in the juice. D. 116 yielding 4,940 lbs., B. 1528 yielding 4,760 lbs., and Sealy Seedling 4,610 lbs.

Experiments carried out at Round Hill, Nevis, during this year place Sealy Seedling first in productiveness with a yield of 5,470 lbs. of sucrose per acre in the juice, followed by A. 2 with 4,910 lbs., and B. 1528 with 4,510 lbs.

From the results of the fertilizer trials it is concluded that under average conditions the amounts of manurial constituents supplied in 20 tons of barnyard manure per acre applied before the crop of plant cane is established provides sufficient plant food for the production of a crop of plant canes, first ratoons, and possibly second ratoons. An additional application of commercial fertilizers, due to the limitation of the moisture supply, is unattended by corresponding increases.

Investigations of the anatomical structure of the leaves of different varieties of spring wheat and its significance in breeding, W. Heuser (*Ztschr. Pflanzenzücht., 3 (1915), No. 3, pp. 335–352*).—This article is devoted partly to a study of the differences in leaf structure of a number of varieties of spring wheat, and partly to a presentation of different views regarding the significance of the size of the plant cell.

The experimental study of the anatomy of wheat leaves, according to the author, showed that varieties comparatively xerophytic in type are characterized by small size of cell. In this connection attention is called to the fact that Kolkunoff bases selection on the small size of cells in breeding for drought resistance. The author questions the advisability of selecting small cell types of wheat for culture under the conditions obtaining in Germany, but suggests the selection of large-celled and small-celled forms from the wheat varieties commonly grown to compare them with reference to the rate of development and to the morphological and physiological characters that distinguish them.

Marquis wheat, C. R. Ball and J. A. Clark (*U. S. Dept. Agr., Farmers' Bul. 732 (1916). pp. 7, figs. 2*).—The history and description of Marquis wheat are given, and its value for the subhumid, semiarid, arid, and irrigated sections is discussed. The recommendations given are based largely on the results secured in 13 States in experiments with Marquis wheat by this Department and a number of experiment stations.

For the subhumid section this variety is regarded as comparing very favorably with the principal spring wheats. In the semiarid section it was found that the durum wheats generally outyield the commonly grown spring wheats, including Marquis. The variety is not recommended for the arid sections nor for any district west of the Rocky Mountains either with or without irrigation. It was shown that Marquis is a first-class milling wheat.

The disinfection of seeds, V. M. ARCHIKHOVSKII (V. ARCICHOVSKIJ) (*Zap. Sta. Isp. Sĭem. Imp. Bot. Sad.* (*Ann. Inst. Essais Semences Jard. Imp. Bot. Pierre Grand*), *2* (*1915*), *No. 6, pp. 107, pl. 1, figs. 7*).—Historical notes on the study of seed disinfection are presented, the author's method of pursuing the work is outlined, and the results secured are reported and discussed. A résumé of the article is given in French and a list of 64 references to literature on the subject is appended.

Different kinds of seeds, including peas, corn, and beans, were treated with solutions of corrosive sublimate, silver nitrate, sulphuric, concentrated hydrochloric, concentrated nitric, chromic, and osmic acids, bromin, chlorin, chlorid of lime, acidulated chlorid of lime, iodin, hydrogen peroxid, formalin, phenol, and soft soap. It is concluded from the results that it is possible to disinfect seeds without destroying their germinative properties, and that chemical substances such as concentrated acids and certain active, especially oxidizing substances such as hydrogen peroxid, chlorin, and bromin, are adapted to the disinfection of seeds. It is stated that in using concentrated acids the organisms on the surface of the seeds are killed before the acids can penetrate into the seeds and destroy their germinability, and that in the case of oxidizing disinfectants the substances absorbed after the seeds are sterilized are not injurious.

Weeds in the poppy fiields of Volhynia and Podolia, K. W. KAMENSKII (KAMENSKY) (*Zap. Sta. Isp. Sĭem Imp. Bot. Sad.* (*Ann. Samenprüf. Anst. K. Bot. Gart. Peter Grossen*), *2* (*1914*), *No. 2, pp. 23*).—The results of a study by which the principal species of weeds occurring in the poppy fields of the two governments were determined are reported. Lists of the weeds are given in tabular form, and the frequency of occurrence of the different species is indicated.

The more common species were *Amaranthus retroflexus*, *Chenopodium album*, and *Setaria glauca*. *Galeopsis ladanum* was also found in both regions, and *Oxalis stricta* appeared to be characteristic of Volhynia. Seeds of *Datura stramonium*, *Xanthium strumarium*, and *X. spinosum*, weeds growing along the roadsides, were also found in the poppy seed.

HORTICULTURE.

The Australian gardener, revised by F. A. FALKNER (*Melbourne: F. H. Brunning Printery, Ltd., 1916, 18. ed., pp.* [8]+*471, pls. 9, figs. 38*).—A manual of information relative to ornamental and vegetable gardening and fruit culture in Victoria, including also a brief section devoted to general farm crops.

Gardening investigations, H. SCHMID (*Landw. Jahrb. Schweiz, 29* (*1915*), *No. 5, pp. 592–601, fig. 1*).—A brief progress report on cultural and breeding investigations with flowers, vegetables, and strawberries conducted at the Wädensweil Station during 1913 and 1914.

The acclimation of plants and their adaptation to soil by means of grafting, J. B. DENTAL (*Rev. Hort.* [*Paris*], *88* (*1916*), *No. 3, pp. 47–49*).—The author enumerates a number of plants which he has successfully adapted to different soil conditions by grafting on certain stocks.

A spraying manual (*Fayetteville, Ark.: Univ. Ark. Ext. Div., 1916, pp. 16, fig. 1*).—This manual contains a monthly working calendar and directions for spraying the more important insect diseases and pests of orchard and small fruits, roses, and vegetables. Directions are also given for preparing various spray mixtures.

How to make hotbeds and cold frames (*Harrisburg, Pa.: The Countryside Press, 1915, pp. 74, figs. 21*).—In this booklet popular directions are given for the construction and management of hotbeds and cold frames, as well as the smaller types of greenhouses.

How to make a vegetable garden (*Harrisburg, Pa.: The Countryside Press, 1915, pp. 73, figs. 14*).—In addition to directions for planning and planting vegetable gardens, specific directions are given for growing some of the more important vegetables, together with a monthly working calendar and planting table.

Some results in size inheritance, B. H. A. Groth (*New Jersey Stas. Bul. 278 (1915), pp. 3–92, pls. 22*).—In continuation of previous reports on heredity and correlation of structural characters in tomatoes (E. S. R., 27, p. 742), this bulletin gives the results and deductions from four generations of tomato crosses. Some data are also given on crosses between varieties of *Solanum nigrum*.

The work done with tomatoes thus far indicates that "the size of cotyledons and first leaves is determined not only by sizes of the respective parental organs, but also by other factors, as for example excess vigor in the F_1 and the size of seed in all generations.

"The range and frequency distribution of size, shape, and number of all characters studied in cotyledons, first leaves, large leaves, and fruits is of the same nature, that is, wider than that of the F_1 or either parent, but like that of a continuous variation, showing in the great majority of cases only a single mode, which agrees closely with the mode of the F_1 unless excess vigor enters as a factor. The dependence of the F_2 frequency distribution on that of the F_1 is much greater than its dependence upon the frequency distributions of the parents. Whether the parents are similar or dissimilar in respect to a certain size character has very little influence upon the F_2 range of sizes as to that character. Instances are given of F_2 frequency distributions which could not have been caused by the Mendelian inheritance of any number of multiple factors.

"The size and shape of the F_1 crosses between $\pm$ round fruits are the geometric means of the parental sizes and shape. In the F_2 the variations in size and shape are caused by the interaction of size and shape factors. When fruits of different shape and size are crossed new shapes and sizes should be expected to appear, some to breed true without the assumption of any multiple factors. The constancy of unit factors of size and shape must be gravely doubted in view of the influence which supposedly absent factors may have upon the development of those present.

"In the discussion the view is expressed that no size character can be due to an absence of a size factor, that an organism can not carry for the same character more than one size factor in a homozygous state or two in a heterozygous state, and that all other sizes appearing in crosses are due to changes in expression induced by the interaction of various factors for size, shape, or other characters. An attempt is made to define a unit factor as a nervous stimulus emanating from the nucleus as part of the centro-epigenetic system in the sense of Rignano. It is suggested that the complexity of the chemical constitution of the nuclear protoplasm, with its multiplicity of electron systems active at all

times and in all cells, is amply sufficient to assume any number of nervous stimuli or unit factors in an organism. It is shown that spontaneous variation (fluctuation), mutation, and the results of selection which run counter to Johannsen's pure line theory might be accounted for if the view advanced is correct.

"The similarity of the F_2 plants of the cross between two varieties of *S. nigrum* to the mutating species of Œnothera is pointed out."

The transmission of productive and other qualities in the propagation of fruit trees through bud selection, G. T. POWELL (*West. N. Y. Hort. Soc. Proc., 61 (1916), pp. 85–93*).—The author gives the results of some of his own investigations with apples, as well as observations on the work of Shamel with citrus fruits in southern California (E. S. R., 34, p. 639), to show that production and other qualities of fruit are transmitted through buds selected from special trees.

Orchard fertilization, W. S. BLAIR (*Ann. Rpt. Fruit Growers' Assoc. Nova Scotia, 1916, pp. 130–145*).—A paper with discussion following, in which the author reviews some of the more important results secured with cover crops, as well as with organic and inorganic manures, in orcharding experiments at the Canada stations.

Pomological investigations, T. ZSCHOKKE (*Landw. Jahrb. Schweiz, 29 (1915), No. 5, pp. 586–592*).—A progress report on pomological investigations conducted at the Wädensweil Station during the year 1913–14.

The results of an experimental test conducted at the station indicate that, contrary to claims made for it, the placing of tin bands or girdles around young fruit trees has no beneficial effect, either in improving the quantity and quality of the fruit or in throwing the trees into early bearing.

Painting tree wounds, H. G. COOK (*Country Gent., 81 (1916), No. 19, p. 988*).—In this article the author reports that his experience in painting tree wounds corroborates the results secured at the New York State Experiment Station (E. S. R., 32, p. 835), in as far as peach tree wounds and small wounds on apple trees under 30 years of age are concerned. He is of the opinion, however, that wounds on older apple trees with slower healing capacity will not be sufficiently protected from decay by annual spraying. Such wounds, though perfectly healed on the outside, may be decayed within.

His method of applying carbolineum or creosote oils to the heartwood without injuring the growing sapwood is described. This consists essentially in lightly charging the brush with oil and painting carefully from the heartwood out, leaving a circle unpainted around the outside from $\frac{5}{8}$ in. to 1 in. in width. In order to stimulate quick healing, the edge of the bark and the sapwood is painted with a liquid wax composed of rosin and beef tallow in solution in alcohol.

Growing fruit for home use in the Great Plains area, H. P. GOULD and O. J. GRACE (*U. S. Dept. Agr., Farmers' Bul. 727 (1916), pp. 39, figs. 25*).—This bulletin supersedes Circular 51 of the Bureau of Plant Industry (E. S. R., 23, p. 42). It discusses sites for fruit plantations, climatic features of the Great Plains, preparation of the land for planting, selection and care of nursery stock, planting operations, and subsequent management of the orchard. A variety list of orchard and small fruits suggested for planting in the Great Plains area is given.

The problem of finding a profitable market for the products of farms in the State of New York, J. J. DILLON (*West. N. Y. Hort. Soc. Proc., 61 (1916), pp. 9–30*).—In this paper the author gives a review of the progress made by the New York State Department of Foods and Markets in the disposal of the state fruit crops through the auction system of marketing.

Cultural methods, cover crops, and fertilization in apple orchards, J. P. STEWART (*Rpt. Bd. Agr.* [*N. H.*], *33* (*1913–14*), *pp. 190–208*).—In this paper the author reviews some of the more practical results secured from the long-continued orcharding experiments in Pennsylvania (E. S. R., 33, p. 238).

Thirty years in a home orchard, F. J. HEACOCK (*Country Gent.*, *81* (*1916*), *No. 20*, *p. 1013*).—The author here presents a complete financial history, including costs and returns, of a two-acre apple orchard. The total cost during the period of 30 years was $1,837.39, and the total net profit $1,356.01.

Experimental orchard work, 1915, W. S. BLAIR (*Ann. Rpt. Fruit Growers' Assoc. Nova Scotia*, *1916*, *pp. 184–211*).—In continuation of previous work (E. S. R., 33, p. 236) the results of cooperative orchard spraying experiments conducted under the direction of the Kentville station in 1915 are summarized.

The following general conclusions are drawn from the investigations as a whole:

Spraying before the leaves open, with special reference to the control of scab, is not likely to give results sufficiently great to pay for its application. Two foliage sprays thoroughly applied, one before blossoming or just after the leaf buds open and the other just before the blossoms open, followed by two applications after blossoming, will give practically clean fruit. The 1.008 specific gravity test strength of lime-sulphur is sufficiently strong to control scab and a greater strength may cause injury to the foliage and fruit.

Lime-sulphur alone is nearly as good a fungicide as lime-sulphur arsenate, but owing to insect injury the arsenate can not be safely omitted. Any of the well-established brands of arsenate appear to give equally good results when used with lime-sulphur. Lime-sulphur is equally as good as Bordeaux for scab control and less liable to russet the fruit. Homemade concentrated and commercial concentrated lime-sulphurs are equally effective for scab control if used at the same specific gravity test. Soluble-sulphur arsenate is not as effective as lime-sulphur arsenate and is liable to cause serious foliage injury. Soluble sulphur is more effective with arsenate of lead than without, this being attributed to the greater adhesiveness of the compound. Barium chlorid proved to be of no practical value for lessening foliage injury when added to soluble-sulphur arsenate. A strength of soluble sulphur generally recommended, 1.5 lbs. to 100 gal. of water, is about as good a fungicide as that of a greater strength.

Protecting the home apple orchard by dusting, D. REDDICK and C. R. CROSBY (*N. Y. State Col. Agr., Cornell Univ. Ext. Bul. 1* (*1916*), *pp. 14*, *figs. 8*).—The authors here give directions for controlling apple diseases and insect pests by the dusting method, with special reference to its use in small orchards.

A successful cold storage for apples, H. F. HANSEN (*Minn. Hort.*, *44* (*1916*), *No. 6*, *pp. 243, 244*).—Directions are given for building a cold storage plant suitable for storing apples on the farm.

The principal parasites of the peach, W. W. CHASE (*Ga. Bd. Ent. Bul. 43* (*1916*), *pp. 47*, *pls. 16*, *figs. 2*).—This bulletin gives brief accounts of the life history and methods of control of the more important insect pests and diseases of the peach. An article on the care and management of peach orchards, by R. C. Berckmans (pp. 40–45), is appended.

A promising new pear stock, F. C. REIMER (*Mo. Bul. Com. Hort. Cal.*, *5* (*1916*), *No. 5*, *pp. 167–172*, *figs. 2*).—In continuation of previous observations relative to the blight resistance of certain pear stocks (E. S. R., 33, pp. 53, 640) the author conducted blight inoculation experiments on trees of a Chinese wild pear (*Pyrus calleryana*), similar to those previously reported by Compere as being blight resistant (E. S. R., 34, p. 55). These inoculations have shown

that different types of this species, while not absolutely immune to pear blight, are very resistant to this disease. In no case did the blight develop in branches more than 0.5 in. in diameter, whereas check trees of Bartlett, Forelle, *P. pashia*, and French pear seedling inoculated with the same lots of bacteria developed the disease readily and part of them are already dead.

As the result of his studies thus far made with blight resistant pear stocks the author finds that no species are absolutely immune to blight, but that in at least three species the blight has been confined to wood not more than one year old. It is suggested that for very cold regions some of the blight resistant forms of the Chinese sand pear (*P. sinensis*), such as the Japanese pear seedlings and others of this type, will prove most desirable as stocks. For the warmer regions *P. calleryana* and its various subtypes appear sufficiently promising to be thoroughly tested.

Report on new small fruits, W. F. Allen (*Trans. Peninsula Hort. Soc. [Del.], 29 (1916), pp. 83–87*).—A report on the cultural value of a number of the newer varieties of strawberries.

Dewberry culture, G. M. Darrow (*U. S. Dept. Agr., Farmers' Bul. 728 (1916), pp. 18, figs. 12*).—A practical treatise discussing the history of the dewberry, site of a plantation, soils, preparation of the soil, planting, intercrops, cultivation, cover crops, fertilizers, systems of training and pruning, winter protection, harvesting, yields, diseases and insects, propagation, duration of the plantation, pollination, varieties, and hybrids and related forms.

A decade of hybridization among American and Leccean vines, G. Ceccarelli (*Staz. Sper. Agr. Ital., 48 (1915), No. 9, pp. 638–648*).—The author gives a record of breeding experiments conducted during the period 1904 to 1913, in which different species of American grapes were crossed together as well as with other important hybrids and with native Leccean grapes.

The grape in Ontario, F. M. Clement (*Ontario Dept. Agr. Bul. 237 (1916), pp. 48, figs. 29*).—A practical treatise on grape growing based largely on commerical practice in Ontario and parts of New York State. Articles on Insects Attacking Grapes, by L. Caesar (pp. 39–44) and Grape Diseases, by J. E. Howitt (pp. 44–48) are also included.

Viticultural investigations, H. Schellenberg (*Landw. Jahrb. Schweiz, 29 (1915), No. 5, pp. 572–586*).—A progress report on viticultural investigations conducted at the Wädensweil Experiment Station during the years 1913–14.

Among the data reported are the cultural value of a number of varieties of grapes, the adaptation of varieties to different stocks, the results of combating insect pests and diseases, and the yields in fruit and juice secured from different grafted varieties.

Varieties of the avocado, F. O. Popenoe (*Altadena, Cal., 1915, pp. 25, pls. 2*).—This is a reprint of a paper on this subject, read at the meeting of the Avocado Growers' Association at Los Angeles in 1915. See also previous note (E. S. R., 34, p. 835).

Our present knowledge of citrus fertilization, H. J. Webber (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 5, pp. 161–163*).—In this paper the author reviews the results of experiments relative to the fertilization of citrus fruits.

Sicilian citriculture, G. Inzenga, edited by L. Savastano (*Ann. R. Staz. Sper. Agrum. e Frutticol. Acireale, 3 (1915), pp. 1–42, pl. 1*).—This comprises a monograph on the various species of citrus fruits which was prepared by the author in 1882 and has not been previously published.

Lemon growing in Santa Agata di Militello, Messina, G. Faraci (*Ann. R. Staz. Sper. Agrum. e Frutticol. Acireale, 3 (1915), pp. 135–192, figs. 10*).—An account of lemon culture in Santa Agata di Militello, discussing soil and cli-

matic conditions, methods of propagation, planting and culture, diseases and insect pests, harvesting, commerce, and cost of production.

Pamburus, a new genus related to Citrus, from India, W. T. SWINGLE (*Jour. Wash. Acad. Sci., 6* (*1916*), *No. 11, pp. 335–338*).—In this article the author names and describes a new genus, Pamburus, to include certain species related to Citrus which have previously been referred to the genus Atalantia.

Olive culture in the environs of Trapani, D. POMA (*Ann. R. Staz. Sper. Agrum. e Frutticol. Acireale, 3* (*1915*), *pp. 111–134*).—A survey of the olive industry in the environs of Trapani, conducted with the view of determining the causes of the decline in the industry. The results of the survey indicate in brief that under better methods of culture and care olive growing might well be extended in that region.

Variation in the flowers of the papaya, L. B. KULKARNI (*Poona Agr. Col. Reprints No. 4* (*1915*), *pp. 11, pls. 3*).—Observations made by the author in the Ganeshkhind Gardens during the years 1910–1913 show that the inflorescence of the male plants of the diœcious type of papaya is unstable. At certain times staminate, pistillate, and hermaphrodite flowers have been observed. With the increase of hermaphrodite flowers there is a decrease of staminate flowers and a gradual appearance of pistillate flowers. At other times the pistillate flowers practically disappear, the number of hermaphrodite flowers is decreased, and the number of staminate flowers increased.

The results of these observations together with the results of some experiments in beheading male plants, lead the author to conclude that, contrary to the opinion advanced by Iorns (E. S. R., 20, p. 444), a change in sex does not appear in any way to be connected with the removal or retention of the terminal bud.

Tea culture on the east coast of Sumatra, C. BERNARD (*Dept. Landb., Nijv. en Handel* [*Dutch East Indies*], *Meded. Proefstat. Thee, No. 41* (*1915*), *pp. 58, pls. 14, figs. 5*).—An account of the tea industry on the east coast of Sumatra, with reference to its extent, cultural practices, methods of harvesting and preparing the tea, and cost of growing and marketing.

A walnut containing a hazelnut kernel, L. DANIEL (*Rev. Gén. Bot., 28* (*1916*), *No. 325, pp. 11–14, figs. 12*).—The author here describes a case of xenia in which a walnut gathered from a tree adjacent to a hazelnut tree was found to contain a kernel similar to the hazelnut. The seedling from this kernel showed walnut leaves.

Bay oil and the cultivation of the bay tree as a crop plant, H. A. TEMPANY and W. ROBSON (*West Indian Bul., 15* (*1915*), *No. 3, pp. 176–197, pl. 1*).—In this paper the author briefly reviews the literature relative to the bay oil and bay rum industries, summarizes the existing information in respect to the culture of bay trees, and gives the principal results of experiments conducted at the Montserrat Station for a number of years in the culture of bay trees and the distillation of bay oil.

The possibility and value of improving the commercial belladonna crop through selection, A. F. SIEVERS (*Amer. Jour. Pharm., 88* (*1916*), *No. 5, pp. 193–215*).—This paper is based upon and presents the more important results of the author's selection and breeding experiments with special reference to increasing the alkaloidal content of belladonna plants (E. S. R., 34, p. 237).

Henna, F. CORTESI and G. TOMMASI (*Ann. Bot.* [*Rome*], *14* (*1916*), *No. 1, pp. 1–27, figs. 6*).—A botanical and chemical investigation of the henna plant (*Lawsonia alba*) is reported.

Report of the committee on plants, C. W. EICHLING, J. RINCK, and J. G. THOMA (*Proc. Ann. Conv. Ry. Gard. Assoc., 9* (*1915*), *pp. 24–32*).—A descriptive

list is given of trees and shrubs recommended for railway gardening by the committee on plants of the Railway Gardening Association.

Trees and shrubs worth planting for their conspicuously ornamental fruits, E. H. WILSON (*Gard. Mag. [N. Y.], 22 (1915), No. 3, pp. 77–80, figs. 11*).—A large number of trees and shrubs valuable for their ornamental fruits are described.

Early spring-flowering trees and shrubs, E. H. WILSON (*Gard. Mag. [N. Y.], 23 (1916), No. 1, pp. 19–23, figs. 12*).—Descriptive notes are given on a large number of early flowering trees and shrubs adapted for ornamental planting.

Midseason flowering trees and shrubs, E. H. WILSON (*Gard. Mag. [N. Y.], 22 (1915), No. 1, pp. 5–9, figs. 6*).—Descriptive notes are given on a large number of midseason flowering trees and shrubs adapted for ornamental planting.

The best of the hardy climbing shrubs, E. H. WILSON (*Gard. Mag. [N. Y.], 22 (1915), No. 2, pp. 31–35. figs. 12*).—Descriptive notes are given on hardy climbing shrubs for ornamental planting.

New Chinese trees and shrubs for the Pacific slope and other favored regions, E. H. WILSON (*Gard. Mag. [N. Y.], 22 (1916), No. 6, pp. 197–200, figs. 8*).—Although the trees and shrubs here described are considered to be of particular value for the Pacific slope and the Gulf coast regions, many of the plants are adapted for culture in the South in the presence of sufficient moisture.

In "lilacdom," E. H. WILSON (*Gard. Mag. [N. Y.], 23 (1916), No. 3, pp. 153–155, figs. 16*).—Descriptive notes are given on various types and varieties of lilacs and their cultivation.

New herbaceous plants from China, E. H. WILSON (*Gard. Mag. [N. Y.], 23 (1916), No. 4, pp. 226–229, figs. 13*).—Descriptive notes are given on a number of herbaceous introductions from China, including suggestions relative to their cultural requirements and adaptation.

"Consider the lilies," E. H. WILSON (*Gard. Mag. [N. Y.], 21 (1915), No. 6, pp. 283–286, figs. 6*).—Under this title the author discusses the cultural requirements of various types of lilies as judged by conditions in their native environment.

The story of the modern rose, E. H. WILSON (*Gard. Mag. [N. Y.], 21 (1915), No. 5, pp. 253–256, figs. 7*).—A brief historical sketch of the present day cultivated roses, including a list of parents of the principal garden roses of the nineteenth and twentieth centuries.

House plants, their care and culture, H. FINDLAY (*New York and London: D. Appleton & Co., 1916, pp. 325, figs. 125*).—In addition to general cultural directions for window and conservatory plants, the control of insects and plant diseases is treated in detail and each plant included is considered with reference to its history, propagation, and culture.

How to make a bulb garden (*Harrisburg, Pa.: The Countryside Press, 1915, pp. 73, figs. 22*).—This booklet contains concise directions for the planting and care of both spring and summer flowering bulbs.

Our early wild flowers, HARRIET L. KEELER (*New York: Charles Scribner's Sons, 1916, pp. XXVIII+252, pls. 20, figs. 94*).—A popular descriptive study of the herbaceous plants habitually blooming in the Northern States during the months of March, April, and May.

A country flower show, J. H. BURDETT (*Country Gent., 81 (1916), No. 20, p. 1045*).—In this article the author gives numerous suggestions dealing with the arranging and holding of country flower shows.

FORESTRY.

Announcements concerning forest and shade trees and basket willows recommended for planting in Idaho (*Univ. Idaho, Dept. Forestry* [*Bul.*], *11* (*1916*), *No. 2, pp. 4*).—This pamphlet contains a descriptive list of trees recommended for various planting purposes in Idaho, together with announcements dealing with the distribution of trees by the State Department of Forestry.

The forests of Mount Rainier National Park, G. F. Allen (*U. S. Dept. Int., Off. Sec.* [*Pub.*], *1916, pp. 33, figs. 26*).—A popular account of forest conditions in Mount Rainier National Park, including descriptions of the more important forest species.

Timber of Russia, M. Tkatchenko (*Internat. Engin. Cong., 1915, Sept. 20–25, Adv. Copy, pp. 24*).—A paper presented at the International Engineering Congress at San Francisco in 1915, giving an account of forest areas and forest ownership in Russia, and of the forests in the different parts of Russia, with reference to distribution of species, yield, mechanical properties, and commercial uses of the timber, lumbering, and management.

Hybrid trees, W. H. Lamb (*Jour. Heredity, 7* (*1916*), *No. 7, pp. 311–319, figs. 4*).—A review of our knowledge relative to natural and artificial hybridization among trees.

British Columbia western larch (Larix occidentalis) (*Brit. Columbia Govt., Forest Branch Bul. 16* [*1916*], *pp. 15, figs. 13*).—This bulletin describes the western larch (*L. occidentalis*) with reference to its range, distinguishing characteristics, and the qualities and uses of the wood.

The yellow locust (Robinia pseudacacia), J. J. Crumley (*Mo. Bul. Ohio Sta., 1* (*1916*), *No. 5, pp. 149–152, fig. 1*).—An account of the yellow locust, with reference to its distribution, habitat, habit of growth, durability of the wood, production and market value, and propagation.

Notes on tapping experiments at Kuala Lumpur.—Third and fourth years' result, F. G. Spring (*Agr. Bul. Fed. Malay States, 4* (*1916*), *No. 6, pp. 168–174*).—Yield data are given for the third and fourth years on a comparative test of six different systems of tapping rubber. The results secured during the first two years (E. S. R., 29, p. 240) are also included.

Tenth annual report of the commissioner of forestry, made to the general assembly at its January session, 1916, J. B. Mowry (*Ann. Rpt. Comr. Forestry, R. I., 10* (*1915*), *pp. 18*).—A progress report on forest conditions in Rhode Island, including data relative to forest fires in 1915 and planting and improvement operations by landowners.

Report of the forest officer for the year 1914–15, C. S. Rogers (*Rpt. Forest Off. Trinidad and Tobago, 1914–15, pp. 6*).—This comprises a brief report relative to the administration and management of the crown forests in Trinidad and Tobago for the year.

Forest Service revenue and organization, T. S. Woolsey, Jr. (*Forestry Quart., 14* (*1916*), *No. 2, pp. 188–235*).—A study of the organization and policy of the Forest Service of the U. S. Department of Agriculture with special reference to their influence on Forest Service revenues.

The cost of forest improvement systems, P. S. Lovejoy (*Forestry Quart., 14* (*1916*), *No. 2, pp. 238–254*).—A discussion of the various cost factors entering into the improvement of forest tracts.

Reforesting methods and results of forest planting in New York State, B. H. Paul (*New York Cornell Sta. Bul. 374* (*1916*), *pp. 649–692, figs. 25*).—This bulletin presents the results of a study made in 1914 relative to reforesting methods in New York State and the results that may be obtained by planting

forest trees on denuded lands and on worn-out agricultural lands. Thirty-five typical forest plantations in various part of the State were studied with reference to conditions of growth and rate of growth of the trees. The subject matter is presented under the general headings of conditions for establishing a successful forest plantation, results of forest planting, and causes of injury to plantations.

Possibilities of private forest management in New York State, C. H. GUISE (*New York Cornell Sta. Bul. 375 (1916), pp. 697–746*).—This bulletin reports a study of the present condition of private forestry in New York State, discusses the possibilities of future management, and presents data showing what rates of interest under average conditions may be obtained on investments in different classes of timber suitable to management in the State.

Briefly summarized it is concluded that white pine and chestnut are capable of yielding the greatest returns as an investment and are at present the only trees, with the possible exception of red pine, that can be safely grown for profit. The danger of bark disease may eliminate chestnut. Inasmuch as a return of scarcely more than 6 per cent can be realized after from 40 to 50 years from the time the initial investment is started, the possibilities of private forestry, on a small scale at least, are not encouraging.

Operations and costs on Pennsylvania state forests, N. R. MCNAUGHTON (*Forestry Quart., 14 (1916), No. 2, pp. 236, 237*).—A summary to date is given of the work done and operation costs on the Pennsylvania state forests.

The reforestation of the antarctic woods, G. T. SCHUSTER (*Bol. Min. Agr. [Buenos Aires], 20 (1916), No. 1–2, pp. 78–102*).—An account of the present condition of forest areas in southern Argentina, together with suggestions relative to reforestation of this region. The Oregon pine (*Pseudotsuga taxifolia*), which is believed to be suitable for this purpose, is considered in detail relative to its botany, characteristics, wood, habitat, and silvicultural requirements.

Seed testing with the Jacobsen germinating apparatus at the Danish Seed Control Station, trans. by J. A. LARSEN (*Forestry Quart., 14 (1916), No. 2, pp. 273–276, fig. 1*).—A short descriptive account of seed testing practices at the Danish Seed Control Station, including a list of papers related to this question issued by this station.

An improved form of nursery seed-bed frame, D. R. BREWSTER (*Forestry Quart., 14 (1916), No. 2, pp. 183–187, pl. 1*).—The author here illustrates and describes a portable, take-down nursery seed-bed frame which has proved to be well adapted for use at the forest experiment stations.

A practical application of Pressler's formula, A. B. RECKNAGEL (*Forestry Quart., 14 (1916), No. 2, pp. 260–267*).—In this paper the author presents data showing how Pressler's well-known formula may be used in a practical way to determine the current annual increment in mixed selection forest and from this to work out the regulation of the cut. The data given were secured from work done by Cornell University students in the Catskills and Adirondacks during 1914 and 1915.

Business rate of interest and rate made by the forest, F. ROTH (*Forestry Quart., 14 (1916), No. 2, pp. 255–259*).—A brief discussion of the position of forestry as a business investment as compared with other business enterprises.

Summary of costs on a flume and railroad logging operation in northern California, N. C. BROWN (*Empire Forester, 2 (1916), No. 1, pp. 41–44, figs. 2*).—Data are given showing the cost of logging and manufacturing lumber on a large tract in northern California. The experience of several years shows that the total logging and manufacturing charges amount to $13.65 per 1,000 ft. b. m.

Measuring and marketing wood-lot products, W. R. MATTOON and W. B. BARROWS (*U. S. Dept. Agr., Farmers' Bul. 715 (1916), pp. 48, figs. 13*).—The purpose of this publication is to assist wood-lot owners in securing maximum returns from wood-lot products. Consideration is given to the nature and classification of the wood-lot products, units used in the measurement of timber, scaling timber, estimating standing timber, finding the sale value of standing timber, markets and prices, shipping by rail, when and how to sell, the small sawmill, cooperation in marketing, how to prevent the deterioration of cut wood-lot products, and practical helps in marketing.

Lumber markets on the east coast of South America, R. E. SIMMONS (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Spec. Agents Ser., No. 112 (1916), pp. 121, pls. 15*).—This is the first of a series of reports reviewing the lumber markets of South America. The present report deals with the domestic lumber resources of Argentina, Uruguay, and Brazil, and the kinds, dimensions, costs, prices, uses, etc., of imported lumber. Trade methods are discussed, and consideration is also given to special lumber products.

DISEASES OF PLANTS.

Report on the work of the Bureau of Mycology and Phytopathology for 1914, A. ÍACHEVSKIĬ (JACZEWSKI) (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 3, pp. 42–51*).—In addition to his previous report (E. S. R., 34, p. 842), the author gives a more detailed account of the work done by the personnel of the bureau in 1914. For the most part the results of plant disease investigations are either published already or prepared for a separate publication in the near future, and for this reason they are only briefly stated in this report.

Experiments to determine control measures for American gooseberry mildew have been continued. Various substances were added to common soda to increase its adhesiveness, but the best results were secured by the use of zinc carbonate and green soap. Barnyard manure increased the amount of the disease, while potash checked it. The author recommends an application in the spring of 30 per cent potash at the rate of about ½ lb. to every 50 sq. ft., followed by a spray consisting of about ½ oz. soda and ¼ oz. green soap in about 3¼ gal. water. This application should be repeated every ten days.

Work on club root of cabbage consisted in testing a variety of soil treatments, such as fall and spring liming and the application of potassium permanganate, calcium chlorid, and soda as preventives of this disease. Fall liming gave the best results, and is considered worthy of recommendation. Combating weeds, destroying diseased plants as soon as they can be noticed with immediate application of lime to the place from which they were removed, collecting and burning all stalks after harvest, and plowing in the fall, accompanied by distribution of lime in furrows at the rate of about 800 to 3,200 lbs. to the acre, are practical suggestions, based on three years' experience.

The work with the so-called "drunk bread" resulted in the isolation from affected grains of two species of Fusarium, *F. roseum* and *F. subulatum*, and consequently it appeared possible to outline certain control measures.

A number of other activities of the bureau are briefly reported upon.

Fungus parasites of the higher plants in the region of Kharkov and adjacent provinces, A. A. POTEBNÍA (*Kharkov. Oblast. Selsk. Khoz. Opytn. Sta. Fitopatol. Otd., No. 1 (1915), pp. 120, figs. 19*).—This publication is the first part of a work which will eventually cover a complete survey of the cryptogamic parasites of plants in the above-named region of the Russian Empire. The present report includes three lower classes of fungi, namely, Schizomycetes (Bacteria), Amœbina (Monadineæ), and Phycomycetes.

Bacterial diseases of plants are said to be of no great economic importance in Russia, and the majority of them are confined to beets. Special attention is given by the author to the *Bacterium beticola* described by E. F. Smith, which produces galls on *Beta vulgaris*. The character of this disease as observed on local specimens is slightly different from that described in America by Smith. Crown gall (*Bacterium tumefaciens*) is present, but the data regarding its prevalence and importance in the province are not complete. An undescribed species of bacterium, named *Bacillus petroselini* n. sp., is said to cause a leaf spot of *Petroselinum sativum*. The author made a special study of a bacteriosis of cucumbers, and he concludes that this trouble is identical with one which was previously reported by Burger in Florida (E. S. R., 31, p. 747). A description is given of the causal organism, *Bacillus burgeri* n. sp.

The group Amœbina (Monadineæ) is given a lengthy discussion. The author describes *Pollinopsis betæ* n. g. and sp. and *Amœba cucumeris* n. sp. The first was isolated from beets affected with *Bacterium beticola*, and the presence of bacteria appeared to be necessary for the development of the amœba, but the question of the pathogenicity of the latter is considered to be an open one. The second organism was obtained from cucumbers affected with *Bacillus burgeri*, and upon examination of local specimens, as well as herbarium specimens from Copenhagen, Denmark, it appeared to be constantly associated with this disease. The author believes that the question of the relation between the bacterium and the amœba is of considerable interest from the phytopathological point of view.

The Phycomycetes give a large number of plant parasites in these provinces. Complete technical descriptions accompany nearly all parasitic organisms in this book.

[Mycological flora of the region of Sukhum], V. SIEMASHKO (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 3, pp. 23–41, figs. 17*).—The author gives a list of fungi collected by him in 1913 and 1914 along the Black Sea coast in Transcaucasia.

Along with parasites and saprophytes of more or less general occurrence this list contains six species described as new to science. One of these, *Exobasidium citri*, attacks young mandarin fruits, forming on their surfaces a heavy sclerotial layer bearing numerous spores. The disease in general symptoms resembles that which Briosi and Farneti ascribed to an aggregate action of *Ovularia citri* and certain other fungi, but the author's fungus is a distinct Basidiomycete. The other five new species, which attack leaves of various plants, are *Mycosphærella phaseolorum* from *Glycine soja*, *Phaseolus mungo*, and *Vigna rubra; Sphærulina suchumica* from *Gossypium herbaceum* and *Hibiscus esculentus; Cercosporella epimedii* from *Epimedium pinnatum colchicum; Ramularia trachystemonis* from *Trachystemon orientalis;* and *Cercospora guizotiæ* from *Guizotia oleifera*.

[Mycological flora of Province Tersk], N. N. VORONIKHIN (WORONICHIN) (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 3, pp. 7–16*).—The author gives a list of fungi which he collected during the summer of 1914 in the regions of Kislovodsk, Pfiatigorsk, and Zhelfeznovodsk, Russian Caucasus. This list includes two parasitic species hitherto undescribed, namely, *Rhodosticta onobrychidis* n. sp., which attacks the leaves of sainfoin (esparcet), and *Cercosporella lini* n. sp., from *Linum nervosum*. Leaf spot (*Septoria piricola*) and rust (*Gymnosporangium sabinæ*) of pear, fruit rot (*Monilia cinerea*) and shothole (*Clasterosporium carpophilum*) of cherry, *Microstroma juglandis* on leaves of walnut, and *Cercospora fraxini* and *Septoglœum ulmi* on leaves of forest trees were the most prevalent of the well-known diseases of economic plants.

The Septoria leaf spot disease of celery or celery blight, G. H. COONS and E. LEVIN (*Michigan Sta. Spec. Bul. 77 (1916), pp. 8, figs. 9; Dutch ed., pp. 8,*

figs. 9).—An account is given of the leaf spot of celery due to *S. apii*, with suggestions for its control. Experiments are reported in which this blight was very successfully controlled by the use of Bordeaux mixture, large increases in merchantable celery being obtained from sprayed plats over those not similarly treated.

Cotton anthracnose, F. M. ROLFS (*Oklahoma Sta. Circ. 40* (*1916*), *pp. 3–7*).—A description is given of the anthracnose of cotton due to *Glomerella gossypii*, with suggestions for control measures. These include seed selection, crop rotation, use of old seed, and treatment of seed with hot water and sulphuric acid.

Potato diseases in New Jersey, M. T. COOK and H. C. LINT (*New Jersey Stas. Circ. 53* (*1915*), *pp. 3–23, figs. 9*).—Prepared as a substitute for Circular 33, previously noted (E. S. R., 31, p. 52).

The diseases of the potato, C. R. ORTON (*Pennsylvania Sta. Bul. 140* (*1916*), *pp. 37, figs. 23*).—A description is given of the more prevalent diseases of the potato, with suggestions for their control as far as definite means are known.

A western field rot of the Irish potato tuber caused by Fusarium radicicola, O. A. PRATT (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 9, pp. 297–310, pls. 4*).—In a previous publication (E. S. R., 34, p. 246), Carpenter gave an account of laboratory investigations on potato rots due to species of Fusarium. In the present publication the author gives the results of experiments carried out under field conditions in an irrigated region of southern Idaho, where the fungus, *F. radicicola*, is believed to be well distributed throughout the soils.

It is claimed that *F. radicicola* is the cause of a field black rot of potato tubers in this section, the disease being principally confined to round types of potato, such as Idaho Rural and Pearl. It is also capable of causing a jelly end rot similar to a rot of that character on potatoes of the Burbank group in southern Idaho, though under actual field conditions other factors are considered partly responsible in producing this disease. Neither the black rot nor the jelly end rot makes any progress in storage if the potatoes are kept below 50° F.

As potatoes infected with black rot will bring about an infection of the following crop, it is considered probable that the black rot may be controlled by planting sound potatoes only on lands which have been in other crops for a number of years and by providing good conditions for growth.

Silver scurf of the Irish potato caused by Spondylocladium atrovirens, E. S. SCHULTZ (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 10, pp. 339–350, pls. 4*).—The results are given of a study of the silver scurf of the Irish potato, part of the investigation on which was carried on at the University of Wisconsin. The symptoms of the disease, its morphology, histology, etc., are fully described.

While there is considerable range in spore dimensions, the author concludes that there is but one species and not two, as other investigators have claimed. The fungus is negatively heliotropic, withstands a wide range of temperature, its growth being inhibited at 2 to 3° C., but it is not killed at —10°. Its optimum temperature for growth is 21 to 27°, with a maximum of 30°.

The disease may be carried by infected tubers, and under favorable moisture and temperature conditions may spread to other tubers in storage. Disinfecting the seed tubers with corrosive sublimate reduced very materially the percentage of infected tubers, and warm solutions were found to have a more toxic effect on the fungus than cold ones.

Notable contributions on diseases and animal enemies of the sugar beet in 1914, A. STIFT (*Bl. Zuckerrübenbau, 22* (*1915*), *Nos. 3, pp. 30–32; 5, pp. 52–*

56).—Condensed notes are given on selected articles on animal pests and plant diseases of the sugar beet in 1914 in Germany and Austria-Hungary.

Dying of young fruit trees, A. H. Cockayne (*Jour. Agr.* [*New Zeal.*], *11* (*1915*), *No. 6, pp. 504–506*).—A serious disease already known to affect several varieties of apples, also other fruits, has recently caused heavy loss. It is characterized outwardly by a wilt of buds or young leaves in early spring and inwardly by a browning of the inner bark and cambium. This browning apparently always extends downward with considerable rapidity, being soon followed in typical cases by a souring of the sap and sooner or later by the death of the tree.

Recent work has shown the trouble to be due to a fungus, though such predisposing factors as unfavorable soil and climatic conditions may favor infection. The mycelium is found in the bark, cambium, and medullary rays and vessels, blocking the water-conducting system. The fungal fructifications found exteriorly have not yet been definitely connected with the internal mycelium. The disease is said to resemble somewhat that caused by *Valsa prunastri* in Europe, though certain specimens have shown fruiting bodies of the coral spot fungus (*Nectria cinnabarina*). The organism is thought to be a wound parasite.

Removal of all affected parts or trees is recommended. Regrafting may, it is thought, be practiced with safety.

Some points on the general care of apple orchards, G. P. Stewart (*Proc. State Hort. Assoc. Penn., 55* (*1914*), *pp. 89–95, pl. 1*).—Discussing measures designed to secure early bearing, control of aphids and red bugs, and immunity to Stippen (or fruit-pit disease), the author submits provisional lists of apple varieties regarded as susceptible in various degrees or as free from the last-named trouble, which is thought to be physiological in its character.

Spot diseases of the apple causing much general confusion, C. Brooks and D. F. Fisher (*Better Fruit, 10* (*1916*), *No. 8, pp. 13–15, fig. 1*).—The authors, presenting to the Washington State Horticultural Association a progress report on studies designed to lessen the prevailing confusion regarding the nature, appearance, causation, and control of the various apple spot diseases, and discussing the origin and applicability of the names used therefor, state that the names to which preference should be given or to which usage is too firmly attached to be readily changed, are bitter pit, fungus fruit spot, Jonathan spot, corky pit (or drought spotting), and stigmonose.

On bitter pit and the sensitivity of apples to poison, II, A. J. Ewart (*Proc. Roy. Soc. Victoria, n. ser., 26* (*1913*), *No. 1, pp. 12–44, pls. 3*).—Having employed in further investigations the methods described in a previous paper (E. S. R., 27, p. 749), the author claims to have shown that it is possible, by applying poison during the starch stage of development of an apple, to produce artificially every symptom of bitter pit. It is stated that the apples found to be most resistant to poison are also most resistant to bitter pit. Low temperatures increase resistance to poison as well as to bitter pit. The poisoning theory is claimed to be in accordance with all that is known with regard to the sensitivity of the pulp cells toward poisons, to their diminishing resistance with increasing age, and to the changes which take place in the cell, the increased percentage of ash in bitter tissue also pointing in the same direction. It is claimed that it is possible to poison the pulp cells of apples by traces of poison so minute as to be incapable of detection by delicate chemical analysis. The browning of apple pulp is said to be due to the oxidation of tannic acid.

Other chemical and biological considerations are discussed, and a critical examination is made of the views set forth in the reports of McAlpine (E. S. R., 32, p. 751; 33, p. 852).

On bitter pit and sensitivity to poisons, III, A. J. Ewart (*Proc. Roy. Soc. Victoria, n. ser., 26 (1913), No. 2, pp. 228–242, pl. 1*).—In pursuance of the work above noted, in which the extreme sensitivity of the apple to poisons was made evident, the author has instituted a comparison between these results and those obtained by studies with potatoes, which are also capable of prolonged semidormant existence and which also become discolored by oxidase action when dead, but which, unlike apples, are capable of further growth after being injured.

It is stated that, in all cases, potatoes are less sensitive to poisons than are apples, differences in resistance varying from 1,000 times with anesthetics to 8 or 10 times with alkali and copper sulphate. Mercuric chlorid and copper sulphate are about equally poisonous to potatoes. Sulphuric acid, while slightly less poisonous than lead nitrate, is about 50 times as poisonous as alkali. Potatoes, like apples, are much more sensitive to poisons at high than at low temperature.

Tannic acid precipitates starch from its aqueous solution. The occasional starch grains found in apples which are resistant to hydrochloric acid are thought possibly to have been in contact with the tannic acid of the cell sap. The presence of from 0.0003 to 0.003 per cent of tannic acid distinctly retards, 0.003 to 0.06 per cent strongly retards, and 0.33 to 1 per cent practically inhibits diastatic action, this effect showing at 35° C., and being more pronounced below 20°. The cell sap of apples may contain as much as 0.1 per cent tannic acid, and bitter pit tissue appears to contain more than does normal pulp. This will protect any starch grains extruded into the cell sap from solution, and in cells bruised during the starch stage, will aid in preventing the starch from dissolving. In the bitter pit cells, however, the starch grains are in the protoplasm, and as long as this is living the tannic acid of the cell sap is not in contact with them or with diastase. Diastase solution loses its solvent action after prolonged contact with pulp of pounded apples.

It is considered as very desirable that a complete numerical analysis of the mineral constituents of bitter pit tissue in bulk be made, paying special attention to metallic elements in small amount, for the purpose of definite guidance for further investigation.

Bitter pit and sensitivity of apples to poisons, H. G. Breidahl and A. C. H. Rothera (*Proc. Roy. Soc. Victoria, n. ser., 27 (1914), No. 2, pp. 191–197*).—Replying to the claims of Ewart above noted, referring to investigations showing an accelerating action of malt diastase, the authors hold that his tannic acid complications are not applicable to the experiments which he discusses, that his assignment of the tannic acid retardation to an action upon the starch is incorrect, and that his experimental results were obtained under conditions and with proportions of reagents entirely different from those in experiments which he criticizes.

On bitter pit and sensitivity of apples to poison, IV, A. J. Ewart (*Proc. Roy. Soc. Victoria, n. ser., 27 (1914), No. 2, pp. 342–349*).—Replying to the observations of Rothera and Breidahl above noted, and also to criticisms at the September meeting of the Royal Society of Victoria, the author states that an accelerating action may be obtained if a resistant and very active diastase be used in large amount, if the tests are made at high temperatures, and if dry bitter pit pulp in which the tannic acid has been oxidized is compared with fresh pulp rich in tannic acid. Results of his own more recent tests are given and claimed to coincide closely with those which he has previously published.

The control of peach leaf curl, A. S. Horne (*Jour. Roy. Hort. Soc., 41 (1915), No. 1, pp. 110–114, fig. 1*).—This is an account of tests made at the

Wisley laboratory on control methods for peach leaf curl due to *Exoascus deformans.*

Of the two principal preparations of copper sulphate in common use, from either of which, if properly made and applied, a film of insoluble and hence nonpoisonous copper is deposited over the surface of the leaves, the metal being rendered soluble in sufficient quantity to kill the fungi when their secretions come in contact with this deposit, Burgundy mixture was chosen for the tests on account of such advantages as the procurability and easy preservation of its ingredients, the convenience in its preparation, and its freedom from gritty particles, which, in case of Bordeaux mixture, tend to clog and wear the nozzles. The gelatinous suspension of copper carbonate which appears when the copper and the sodium salt are mixed cold and which, while harmless to the plant, is deadly to the fungus, also increases the degree of adhesiveness, and this is further augmented by addition of a little milk. The experiments thus point to the possibility of a still further increased efficiency in the use of Burgundy mixture. In most cases, excellent results followed the use of the Wisley Burgundy mixture, in which 0.75 pint milk was added to 9.75 oz. copper sulphate and 11 oz. sodium carbonate contained in 3 gal. water.

Pathological histology of strawberries affected by species of Botrytis and Rhizopus, N. E. Stevens (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 10, pp. 361–366, pls. 2*).—In a previous publication (E. S. R., 31, p. 645) F. L. Stevens, reporting on some diseases of strawberries, stated that, while a species of Botrytis is the primary cause of the condition known as leaks, it merely initiates the trouble, opening the way for other saprophytes, such as Rhizopus. In order to determine as far as possible the relations of these fungi in rotting berries, the author carried on experiments, noting particularly the differences which exist in their method of attacking the fruit.

The Botrytis was found to penetrate all parts of the berry, growing within the cells as well as between them, and to ramify through the tissues of the berry, filling them with a network of mycelium. On the other hand, the mycelium of Rhizopus was found chiefly in the outer portion of the berry, the hyphæ growing between the cells, separating them, and apparently extracting the cell sap. In comparatively few cases were both fungi found on the same berry, and in no instance has the author found Rhizopus following in a berry originally infected with Botrytis. He considers that *Rhizopus* sp. is not dependent on the presence of any other fungus in its attacks on strawberries during shipment and on the market.

Notes on diseases of cultivated crops observed in 1913–14, S. F. Ashby (*Bul. Dept. Agr. Jamaica, n. ser., 2 (1915), No. 8, pp. 299–327, pls. 2*).—The author gives the results of observations on diseases affecting coconut palms, cacao, banana, and citrus fruits, with recommendations regarding fungicides, insecticides, and spraying outfits.

A rot of bananas, J. F. Dastur (*Agr. Jour. India, 10 (1915), No. 3, pp. 278–284, pls. 3*).—Reporting observations made on a disease of banana at Pusa since May, 1914, the author points out some resemblances and differences between the organism found in connection therewith, a Fusarium with a Cephalosporium stage, and that reported by Drost and Ashby (E. S. R., 29, p. 350) to be the cause of the Panama disease of bananas.

A fungus disease of banana, D. Thomatis (*Bol. Dir. Gen. Agr. [Mexico], 5 (1915), No. 1, pp. 59–61*).—In parts of Oaxaca and Tabasco, banana culture is threatened with serious loss from a disease which is but little known at this time, but which has been provisionally described as being associated with a fungus and as affecting the character and circulation of the sap. It may be identical with a disease of banana in the western portion of Cuba.

A disease of Mirabilis jalapa inherited according to Mendel's law, C. CORRENS (*Jahrb. Wiss. Bot.* [*Pringsheim*], *56* (*1915*), *Pfeffer-Festschr., pp. 585–616, pl. 1, figs. 11*).—Attention is called to a phenomenon consisting of a mottling, slight pitting, and partial rolling of the leaves in *M. jalapa.* This is stated to be due to a sort of degeneration of certain palisade and overlying epidermal cells with enlargement of cells in neighboring areas, the lower leaf surface remaining relatively unchanged. The phenomenon appears to be inherited according to the Mendelian formula and may possibly throw some light on the nature and mode of inheritance of characters.

Bark scraping and bark affections, A. SHARPLES (*Agr. Bul. Fed. Malay States, 3* (*1915*), *No. 11, pp. 420–425*).—It is stated that, while the canker of rubber trees caused by *Phytophthora faberi* is unknown in Malaya, what is supposedly the first bark affection known in this region has recently appeared in the form of a slow rotting of the bark, over which numerous saprophytic fungi were growing. The bark became waterlogged and subject to attack by borers, necessitating the removal of the tree.

It appeared probable that the fundamental cause of the trouble was a method of scraping supposed to stimulate the tree to an increased flow of latex. Tests made under controlled conditions are said to have shown that the removal of the outer corky layers increased the susceptibilty of the tree to attack by fungi and insects. This increase of susceptibility was less if the green cork cambium was left intact, so that this is apparently the protective layer that is the most important in this connection, and not the lactiferous layer, as formerly supposed. Further discussion is given of the conditions and phases of attack by insects and fungi, and the interrelations of the two classes of parasitism.

It is considered that bark scraping of any description should be carried out with discretion, also that until more positive knowledge is obtained as to the function of the latex in the economy of the tree, a conservative attitude is desirable in connection with methods for artificially increasing the flow of latex. It is considered as a still unsettled problem of prime importance to the future of the rubber industry whether latex is a primary product, the withdrawal of which means increased activity for its replacement, or a secondary or waste product.

Bordeau mixture as a spray for rubber trees, A. SHARPLES (*Agr. Bul. Fed. Malay States, 3* (*1915*), *No. 12, pp. 447, 448*).—During experiments carried out in 1914 as already noted (E. S. R., 33, p. 151) the effects of Bordeaux mixture on the rubber obtained during its use were noted, and these are briefly described in this article. It is asserted that there is little danger in using Bordeaux mixture as a spray against the attacks of fungi on rubber trees, but that trees in bearing should be rested for two or three days after such application.

[On the occurrence of Coniophora cerebella in the woods], V. MARTENS (*Mat. Mikol. i Fitopatol. Ross., 1* (*1915*), *No. 3, pp. 52–56, figs. 7*).—The author observed a peculiar rot of fir trees in northern Russia, in the regions of Vologoda and Archangel. From the diseased areas adjacent to the healthy tissue, he isolated a fungus which in certain morphological characters resembles very closely *C. cerebella.* If further studies confirm this tentative conclusion, this, it is said, will be the first report on the occurrence of this fungus on living trees in the woods.

Mistletoe injury to conifers in the Northwest, J. R. WEIR (*U. S. Dept. Agr. Bul. 360* (*1916*), *pp. 39, pls. 4, figs. 27*).—According to the author, *Larix occidentalis, Pinus ponderosa, P. contorta,* and *Pseudotsuga taxifolia* are subject to attacks of *Razoumofskya laricis, R. campylopoda, R. americana,* and *R.*

douglasii in the order named. The mistletoe causes a gradual reduction of the leaf surface of the host plant, trees of all age classes being liable to infection. Excessive mistletoe infection of the lower parts, it is said, may cause the upper portion to die, resulting in the condition commonly called staghead. Seedlings from three to six years old are often killed within a comparatively short time after infection. Where the mistletoe occurs on branches, it usually causes the formation of large witches' brooms which seriously interfere with the life functions of the tree. The author claims that mistletoe can be controlled by cutting out and burning the infected trees, particular attention being paid to centers of infection.

Self-protection by some plants against Cuscuta, O. GERTZ (*Jahrb. Wiss. Bot. [Pringsheim], 56 (1915), Pfeffer-Festschr., pp. 123–154*).—This deals with the relations of Cuscuta to various hosts as regards protective devices against its parasitic activity, more particularly acids, oils, etc., within the plant itself. A bibliography is appended.

Free-living nematodes of Switzerland, B. HOFMÄNNER and R. MENZEL (*Rev. Suisse Zool., 23 (1915), pp. 109–243, pls. 3; abs. in Jour. Roy. Micros. Soc., No. 6 (1915), p. 580*).—This account of the lacustrine and terrestrial nematodes of Switzerland includes a diagnostic key and increases the number of species to 110. Eighteen new forms are described and the genus Criconema is erected.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A preliminary report upon the economic status of the British species of woodpeckers and their relation to forestry, W. E. COLLINGE (*Jour. Bd. Agr. [London], 22 (1915), No. 8, pp. 789–791*).—This preliminary report gives the results of an examination of the stomach contents of 91 specimens of three species of woodpeckers. Fully 75 per cent of the food was found to consist of injurious insects. The author concludes that woodpeckers are distinctly beneficial to forestry and merit all the protection that can be afforded them.

A new bat from Porto Rico, H. H. T. JACKSON (*Proc. Biol. Soc. Wash., 29 (1916), pp. 37, 38*).

[A list of parasites of animals in Guam], B. H. RANSOM (*Jour. Parasitology, 2 (1915), No. 2, pp. 93, 94*).—A list is given of identifications made of 19 species of parasites, including 3 trematodes, 1 cestode, 9 nematodes, 5 arthropods, and 1 protozoan, collected by L. B. Barber of the Guam Experiment Station.

Agricultural entomology (*Entomologia Agraria. Florence: R. Min. Agr. Indus. e Com., 1915, pp. 484, figs. 415; abs. in Rev. Appl. Ent., 4 (1916), Ser. A, No. 2, pp. 53, 54*).—A manual of insects injurious to cultivated plants, field and garden crops and their products, and methods of controlling them.

[Economic entomology] (*Ztschr. Angew. Ent., 2 (1915), No. 2, pp. V+265–471, figs. 63*).—The papers presented in this number include the following: A Contribution to the Biology of the Body Louse (*Pediculus vestimenti*), by A. Hase (pp. 265–359); The Wheat Bulb Fly (*Hylemyia coarctata*), A Contribution to the Knowledge of Its Biology and Its Economic Importance, by R. Kleine (pp. 360–389); List of Parasitic Hymenoptera Reared at the Imperial Plant Protection Station, Vienna, by F. Ruschka and L. Fulmek (pp. 390–412); *Calosoma sycophanta*, Its Life History and Distribution, etc., together with Notes on *C. inquisitor*, by G. Holste (pp. 413–421), the former being a review of work by the Bureau of Entomology of the U. S. Department of Agriculture; New and Little-Known Plant Pests from Our Colonies, by F. Zacher (pp. 422–426); etc.

Annual report of the state entomologist for 1914, E. L. WORSHAM (*Ga. Bd. Ent. Bul. 42 (1915), pp. 5–32, pls. 8*).—This report presents notes upon the work of the year, including inspection and research work, seed selection and the boll weevil, experiments for the control of fruit insects and diseases, pecan insects and diseases, and truck crop pests.

Seventh annual report of the state entomologist of Indiana, C. H. BALDWIN (*Ann. Rpt. State Ent. Ind., 7 (1913–14), pp. 250, figs. 164*).—This report (E. S. R., 31, p. 452) contains papers on the Insects of the Year 1913–14 (pp. 13–58); Diseases of the Year (pp. 59–67); Pruning and the Care of Trees in Relation to Disease and Insect Control, by A. P. Swallow (pp. 71–101); Report of the State Inspector of Apiaries, 1914 (pp. 102–104); A Program for the Treatment of Orchard Insect Pests and Plant Diseases, by C. H. Baldwin and H. F. Dietz (pp. 109–204); and a Circular of Information for Beekeepers, by B. F. Kindig (pp. 205–250).

Eighth annual report of the state entomologist of Indiana, C. H. BALDWIN (*Ann. Rpt. State Ent. Ind., 8 (1914–15), pp. 321, figs. 181*).—This report first presents a list of Indiana nurserymen and brief accounts of the insects of the year 1914–15 (pp. 12–29), and of plant diseases during the period under report (pp. 30–41), a report of the state inspector of apiaries (pp. 42–48), and the text of the horticultural and bee inspection laws of Indiana, together with a résumé of the nursery inspection laws of the other States and Canada (pp. 49–85). It also includes a revision of A Program for the Treatment of Orchard Insect Pests and Plant Diseases (pp. 89–190), noted in the preceding abstract, and a paper on The Coccidæ or Scale Insects of Indiana, by H. F. Dietz and H. Morrison, with drawings by R. E. Snodgrass (pp. 195–321). Sixty-two valid species of scales recognized as occurring in Indiana are described and keys given for their separation. A field key to the scales based upon superficial characters is included.

Minnesota state entomologist's reports index, O. J. WENZEL (*Minn. State Ent. Circ. 38 (1916), pp. 40*).—This is an index to the 15 annual and biennial reports of the state entomologist of Minnesota, published between 1895 and 1914, together with an appendix listing other publications of the state entomologist and the division of entomology of the University of Minnesota.

[Insect pests in New Hampshire], W. C. O'KANE (*N. H. Dept. Agr., State Moth Work Circs. [1912], Nos. 1, pp. 4, figs. 4; 2, pp. 4, figs. 4; 3, pp. 4; 4, pp. 2; 1915, No. 5, rev., pp. 4*).—These several circulars deal with the gipsy moth, the brown-tail moth, the control of the gipsy moth in woodlands and orchards, public measures against the gipsy and the brown-tail moths, and the control of the gipsy moth, the last named being previously noted (E. S. R., 32, p. 850).

Tenth report of the state entomologist and plant pathologist of Virginia, 1914–15, W. J. SCHOENE (*Rpt. State Ent. and Plant Path. Va., 10 (1914–15), pp. 75, pls. 3, figs. 5*).—This biennial report (E. S. R., 31, p. 248) first presents an outline of work for the two-year period from October 1, 1913, to September 30, 1915, followed by a Report of Inspection Work, 1914–15, by W. J. Price (pp. 9–15), and an account and the text of the Court Decision Upholding the Cedar Rust Law, by the author (pp. 16–29).

A Report on the Investigation of Insects Affecting Truck Crops in Virginia, by L. B. Smith (pp. 30–63), next presented, deals in large part with investigations of the biology of the green pea aphis (*Macrosiphum pisi*) in eastern Virginia. An account of work with control measures for this insect has been previously noted (E. S. R., 32, p. 652). This aphid has for the past 15 years been causing serious losses to the pea growers in eastern Virginia. The damage to the spring crop occurs usually during May and June, while the fall crop is subject to attack during September and October. Severe attacks of the aphis

cause the plants to wither, become dry, and finally die, usually before the crop has matured. This aphid changes food plants usually four times during the season, those serving as hosts in this region including crimson clover, garden peas, red clover, sweet peas, *Lespedeza* sp., vetches, alfalfa, sweet clover, alsike, white clovers, and shepherd's purse.

"In general the pea aphid passes the winter on clovers, in April they migrate to garden peas, upon which they feed until the first part of July. They then go to the summer food plants, which include sweet clover, *Lespedeza* sp., alfalfa, and the clovers. During August they return to garden peas, where they remain until November and December, when they migrate for the fourth time, this time returning to the clovers, upon which the winter is passed. The foregoing statements of the migrations apply to the majority of the aphids, for doubtless many individuals continue to breed on the clovers throughout the year.

"No true oviparous females or the eggs of the species, have been found in this region, although a few males were collected on garden peas in November, 1914. The viviparous females which pass the winter enter into hibernation during December and commence reproducing in March. No reproduction, and very little feeding, has been observed during January and February.

"The presence of many parasitic and predacious enemies, together with the aphidid fungus, tend to keep the aphids in check during the summer.

"In 1914 there were 21 generations produced between May 1 and December 10. In 1915 there were 22 generations between March 19 and December 5. The age at which females began reproduction varied from 7 to 26 days, it being noticeably longer in the spring and fall than during the summer. From a series of 87 individuals the average age at which reproduction commenced was 12.1 days. The length of the reproductive period varied from 4 to 36 days, an average for the two seasons of 84 records being 18.1 days. The period between the birth of the last young and the death of the female, from 74 records, averaged 1.2 days. The average length of life of viviparous females, from 83 records, including two seasons, was 31.7 days. The average length of life of hibernating females was 134 days.

"The number of young born per day by viviparous females varied from 1 to 11. The total maximum number born by any one female was 142. The average number born per female, from 83 records, was 80.7 young. The fecundity of the females was greatest during July, August, and the early part of September. It has been found that the wingless viviparous females apparently mature in less time and have greater reproductive power than do the winged forms. The fecundity of the winged hibernating females is not as great as that of the wingless or the winged viviparous summer forms.

"The pea aphis molts four times. An average of the lengths of the first four instars, from 60 individual records, is as follows: First instar, 1.6 days; second instar, 2.6 days; third instar, 2.8 days; fourth instar, 2.4 days; thus making the average age at the time of the fourth molt, 9.6 days. As might be expected, the period of development was considerably shorter during the warmer summer months than during the cooler periods in the spring and autumn."

Observations on the Life Histories and Habits of the Species of Aphids Most Common on the Cultivated Apple (*Malus malus*) in Virginia (Blacksburg) during the Season of 1915, including the oat aphis (*Aphis avenæ*), the rosy aphis (*A. sorbi*), and the apple aphis, and a list of the more recent literature relating to these species, by M. T. Smulyan, are appended (pp. 64–75). *A. sorbi* is apparently the most injurious of the three in Virginia and the apple aphis probably the least. The author reports that his investigations of the alternate or summer host plants of *A. sorbi* in Virginia have substantiated the

findings of Ross in Canada that apterous and alate viviparous females and pupæ occur on the common or broad-leaved plantain (*Plantago major*) and English or narrow-leaved plantain (*P. lanceolata*).

Notes on the acarid and insect enemies of cultivated plants observed in the Province of Turin in 1913, G. DELLA BEFFA (*Ann. R. Accad. Agr. Torino, 57 (1914), pp. 35–78, figs. 12*).—These notes relate to 342 insect pests.

Contribution to the knowledge of West African insect pests of plants, F. ZACHER (*Tropenpflanzer, 18 (1915), No. 9–10, pp. 504–534, figs. 35*).—A general survey of the field, including a list with the scientific, German, and local names of 82 insects, the nature of their injury, and the locality where found.

Annual report of the government entomologist, W. SMALL (*Ann. Rpt. Dept. Agr. Uganda, 1915, pp. 71–78*).—A report upon the occurrence of and work with the insect enemies of coffee, cacao, rubber, cotton, etc.

Report of the entomologist, W. H. PATTERSON (*Govt. Gold Coast, Rpt. Agr. Dept., 1914, pp. 21–24*).—A brief report of the work of the year.

The ecology of some endophytic larvæ.—Observations and experiments, E. RABAUD (*Bul. Sci. France et Belg., 46 (1912), No. 1, pp. 1–28, fig. 1; 48 (1914), No. 2, pp. 81–159, fig. 1*).—The first paper deals with *Olethreutes oblongana* in the heads of wild teazel (*Dipsacus sylvestris*); the second with *Myelois cribrella* and some other caterpillars which live in the heads of members of the thistle tribe.

Locusts (*Agr. News [Barbados], 14 (1915), No. 343, p. 202*).—An invasion of Trinidad by the South American migratory locust (*Schistocerca paranensis*) is reported. Large swarms began to arrive on Chacachacare Island from Venezuela on May 30.

A preliminary list of the Jassoidea of Missouri with notes on species, E. H. GIBSON and E. S. COGAN (*Ohio Jour. Sci., 16 (1915), No. 2, pp. 71–78*).

The stick-lac insect, L. DUPORT (*Bul. Écon. Indochine, n. ser., 18 (1915), No. 112, pp. 182-189*).—An account is given of the biology of this scale (*Tachardia lacca*) and its natural enemies.

The development of the Phylloxera vastatrix leaf gall, H. R. ROSEN (*Science, n. ser., 43 (1916), No. 1102, pp. 216, 217*).—The author finds that the withdrawal by phylloxera of a large amount of material at one point from tender growing leaves with subsequent changes in tension and pressure at that point and certain structural peculiarities of the gall itself all suggest the sucking action as the initial stimulus for gall production.

Woolly pear aphis, A. C. BAKER and W. M. DAVIDSON (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 10, pp. 351–360, fig. 1*).—The woolly aphis known for some years to attack pear roots in California and previously considered to be the woolly apple aphis (*Eriosoma lanigerum*), which it resembles in both habit and structure, has been found by the authors to represent a new species which they here describe as *E. pyricola*. In addition to the description the authors consider its history, habits, spread, and biology. The species occurs over practically all the pear sections of northern and central California, where in some regions it is very destructive, and is recorded as having been collected at Wooster, Ohio, in the fall of 1897 on roots of pear stock received from France the preceding spring. It appears to have been present in California for more than 20 years, having ruined some 2,000 French seedlings in one block about ten years ago.

This species works entirely underground, apparently attacking the roots of all types of pears, although especially injurious to the French wild stock so largely used in California as a stock for the Bartlett. It works especially upon the smaller fibrous rootlets and may be encountered on any such rootlets within the topmost 3 ft. of soil and perhaps deeper. The infestations are usually

heavier on the rootlets near the trunk, but frequently the aphids are as abundant 10 or 12 ft. from the stem. Badly stunted growth and early falling of the foliage are characteristic of its injury on young trees. "Injury and death are due to heavy summer and autumn infestations on the fibrous rootlets and to the inability of the tree to replace the destroyed roots quickly enough to afford plant food for the vegetative portion. . . . In orchards and districts where conditions favor large productions of winged forms, or migrants, spring and early summer infestations are small, denoting that few insects passed the winter on the roots. After the month of June, however, such infestations multiply rapidly and become very large by September, the month in which the fall migrants are produced in greatest abundance. After September there remain small wingless colonies which increase but little until the summer following. The winged forms are produced in abundance on heavy dry clay soils which crack in summer and autumn. . . . Occasionally the wingless infestations are severe the year round; where this is so, in the early part of the year there is caused a considerable stunting of growth and more or less weakening, unless the trees can put out plenty of new rootlets to replace those injured and destroyed. This condition has been noted especially on light clay soils where poor cultivation was employed."

In considering the biology of this species a comparison is made of *E. pyricola* with *E. lanigerum* and of the fall migrants of *E. pyricola*, *E. lanigerum*, and *E. americanum*. The new species is easily distinguished from *E. ulmi* from the fact that segment V bears prominent transverse sensoria, and the wingless forms can be distinguished from those of *E. lanigerum* by the structure of the compound wax pores and the winged forms by the antennæ.

Capsid bugs, J. C. F. FRYER (*Jour. Bd. Agr.* [*London*], *22* (*1916*), *No. 10*, *pp. 950–958*, *pls. 2*).—This is a brief summary of the present state of our knowledge with regard to the injury to apple trees and fruit now generally ascribed to plant bugs of the family Capsidæ.

Ooencyrtus pacificus, a new egg parasite from Fiji, J. WATERSTON (*Bul. Ent. Research*, *6* (*1915*), *No. 3*, *pp. 307–310*, *figs. 1*).—This parasite was reared from the eggs of the bean bug (*Brachyplatys pacificus*) at Rarawai, Viti Levu, Fiji.

The insect vector of uta, a Peruvian disease, C. H. T. TOWNSEND (*Jour. Parasitology*, *2* (*1915*), *No. 2*, *pp. 67–73*, *fig. 1*).—A disease known as uta, which occurs on the west face of the Andes in Peru, has been proved to be due to a Leishmania. Two species of gnats of the genus Forcipomyia are said to have been proved capable of transmitting this Leishmania. "It is highly probable that the various forms of leishmaniasis thus far known are due to as many species of herpetomonads originally parasitic in the gut of the insect carriers concerned, and that, with regard to the occurrence in man, these herpetomonads are as yet in the stages of parasitism ranging from habitually abnormal or frequent to merely accidental or infrequent."

A classification of the Lepidoptera based on characters of the pupa, EDNA MOSHER (*Bul. Ill. State Lab. Nat. Hist.*, *12* (*1916*), *Art. 2*, *pp. 13–159*, *pls. 9*).—Investigations by the author have led to this classification, based on pupal characters. An attempt has also been made to throw some light on the relationships existing between the different groups.

Tineid moths of Central America, LORD WALSINGHAM (*Biol. Cent. Amer.*, *Zool.*, *Lepidoptera-Heterocera*, *4* (*1909–1915*), *pp. XII+482*, *pls. 10*; *rev. in Nature* [*London*], *96* (*1916*), *No. 2411*, *pp. 533*, *534*).—The several fascicles of this volume deal with the Tineina. In the preparation of this work the author has been assisted by J. H. Durrant and A. Busck, the latter of the Bureau of Entomology of the U. S. Department of Agriculture.

The introduction and establishment in Canada of the natural enemies of the brown-tail and gipsy moths, J. D. TOTHILL (*Agr. Gaz. Canada, 3 (1916), No. 2, pp. 111–116, fig. 1*).—A detailed account is given of the distribution of the parasitic and predacious enemies of these moths in Canada, together with a map showing their distribution.

The brown Ctenucha (Ctenucha brunnea), E. O. ESSIG (*Jour. Ent. and Zool., 7 (1915), No. 4, pp. 241–244, pl. 1*).—This lepidopteran occurs in the coast region from San Francisco to the southern part of California, where it is found feeding on the leaves of California wild rye (*Elymus condensatus*). The caterpillars are effectively parasitized by a new species of Protapanteles, which in confinement was reared from about 95 per cent of the caterpillars. This parasite is attacked by a hyperparasite (*Hemiteles* n. sp.).

The larvæ of a noctuid moth also feeds on this host plant at Ventura and is said to be much more destructive to the plant. It burrows into the centers of the stems in which it feeds and remains until ready to pupate.

Cutworms and their control in corn and other cereal crops, W. R. WALTON and J. J. DAVIS (*U. S. Dept. Agr., Farmers' Bul. 739 (1916), pp. 8, fig. 1*).—A brief popular account.

The true army worm and its control, W. R. WALTON (*U. S. Dept. Agr., Farmers' Bul. 731 (1916), pp. 12, figs. 8*).—This popular account of (*Heliophila*) *Cirphis unipuncta* and means for its control is of general interest to crop growers.

The clover leafhopper and its control in the Central States, E. H. GIBSON (*U. S. Dept. Agr., Farmers' Bul. 737 (1916), pp. 8, figs. 5*).—An account of *Agallia sanguinolenta*, its habits and mode of attack, together with information as to the control of outbreaks in alfalfa and clover fields.

The species is distributed generally throughout the United States and its range extends into southern Canada and Mexico. Its primary injury is produced by direct feeding, as many as 600 individuals having been counted on a single plant. A second form of injury is produced by the forcing of the eggs into the stem and leaf tissue by the adult female, which causes a distortion of the surrounding tissue and often results in a gall-like formation. Its principal host plants are leguminous, including alfalfa, clover, cowpeas, and vetch, but it is common on meadow and pasture lands and feeds on a number of cultivated as well as native grasses.

The eggs hatch in from 5 to 12 days in summer in the latitude of southern Illinois. Five molts are passed by the nymphs, which require from 18 to 35 days, with an average of 25 days for development. The number of generations produced varies annually with the weather and with the latitude, there usually being three distinct broods in southern Missouri and northern Arkansas. In the Northern States the clover leafhopper hibernates in the adult stage, at the base of clumps of grass and weeds and under dried leaves and trash. Nymphs can not long survive cold weather, and it is not probable that the eggs survive over winter. In the extreme Southwest the leafhopper is active throughout the entire year.

The hopperdozer, a frame for which is illustrated, is recommended for use in its direct control. Mention is also made of the importance of burning rubbish and waste vegetation, close cutting or pasturing of grasslands, and the early cutting of alfalfa as control measures.

The dipterous family Scatopsidæ, A. L. MELANDER (*Washington Sta. Bul. 130 (1916), pp. 3–18, pls. 2*).—In this account, 18 species of Scatopsidæ from the United States are recognized, six of which are described as new to science. It is pointed out that these flies are of economic importance through their habit of breeding in filth.

Notes on beet or mangold fly, A. D. Imms (*Jour. Bd. Agr. [London], 22 (1915), No. 9, pp. 881–884*).—A brief account of the distribution, life history, and methods of control of *Pegomya hyoscyami betæ*. A detailed account by Cameron of the life history of this species has been previously noted (E. S. R., 32, p. 351).

The yellow currant and gooseberry fruit fly (Epochra canadensis), L. A. Whitney (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 4, pp. 152–157, figs. 5*).—This fruit fly, which is generally distributed throughout the currant and gooseberry growing districts of the United States and Canada, is in California apparently confined to the central and northern parts of the State. Technical descriptions are given of its life stages, together with a summary of control work with the cherry fruit flies in New York State, adapted from New York Cornell Experiment Station Bulletin 325, previously noted (E. S. R., 29, p. 55).

Life histories and methods of rearing Hessian fly parasites, C. M. Packard (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 10, pp. 367–381, pls. 2*).—This report of studies made of the life history, habits, and relative efficiency of Hessian fly parasites during the seasons of 1914 and 1915 deals with three hymenopterans, namely, *Eupelmus allynii*, *Merisus destructor*, and (*Merisus*) *Micromelus subapterus*. The methods of rearing found most satisfactory are first described.

The egg of *E. allynii* requires a period of from 1.5 to 5 days for incubation from July to November; from 7 to 10 days are required by the larva to pass through the five instars and complete its growth, and from 9 to 24 days for development in the pupal stage. As many as 58 eggs are recorded as having been laid by each of two females. It is stated that W. R. McConnell has ascertained that this species can reproduce parthenogenetically.

M. destructor requires from 1.5 to 4 days for its embryonic development; from 7 to 11 days for the development of the larva; and 7 to 14 days from the formation of the pupa to the emergence of the adult. A total of 39 eggs is recorded as having been laid by a single female.

M. subapterus was found to require from 1.5 to 5 days for the development of the eggs; from 7 to 10 days for the growth of the larva; and from 7 to 13 days for the development of the pupa. A total of 103 eggs is recorded as having been deposited by a single female.

The author's experiments and observations have led to the inference that only one specimen of any of the three species studied ever matures in a single Hessian fly puparium. In every instance where more than one egg or larva was placed on the same host or in the same cell, one survived and the rest were killed by that one or starved to death. This was true whether the two or more larvæ were of the same or different species.

Studies of agricultural biology.—I, Account of the glossines or tsetse flies, E. Hegh (*Études de Biologie Agricole: No. 1, Notice sur les Glossines ou Tsétsés. London: Belgian Govt., 1915, pp. 148, figs. 29*).—This reports studies of the tsetse flies.

A chemotropic response of the house fly (Musca domestica), C. H. Richardson (*Science, n. ser., 43 (1916), No. 1113, pp. 613–616*).—The author here presents a preliminary report on tests of the response of the house fly to a number of inorganic and organic compounds which occur as products of fermentation in barnyard manures. Negative results were obtained in all but the ammonium hydroxid and ammonium carbonate experiments.

Flytraps and their operation, F. C. Bishopp (*U. S. Dept. Agr., Farmers' Bul. 734 (1916), pp. 13, figs. 7*).—A popular account of supplementary means for controlling flies.

Phyllophaga Harris (Lachnosterna Hope): A revision of the synonymy and one new name, R. D. GLASGOW (*Bul. Ill. State Lab. Nat. Hist., 11 (1916), Art. 5, pp. 365–379*).—As stated by the author this preliminary paper is designed to indicate the progress of the work with the white grubs or May beetles and to present the changes in synonymy that a thorough study of the types has shown to be necessary.

A new species which is abundant in southern Illinois in midsummer is described as *Phyllophaga forbesi.*

On certain beetle larvæ found in sugar plantations, P. VAN DER GOOT (*Arch. Suikerindus. Nederland. Indië, 23 (1915), No. 20, pp. 789–830, figs. 13; Meded. Proefstat. Java-Suikerindus., 5 (1915), No. 10, pp. 275–316, figs. 13; abs. in Rev. Appl. Ent., 4 (1916), Ser. A, No. 3, p. 89*).—Descriptions are given of 16 species of beetles, the larvæ of which were collected in sugar plantations in Java during February and May, 1914, while searching for parasites of *Adoretus compresesus,* together with notes on their bionomics and parasites.

The cassava grubs, S. LEEFMANS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 13 (1915), pp. 121, pls. 11; abs. in Rev. Appl. Ent., 4 (1916), Ser. A, No. 2, pp. 82–84*).—Two beetles are said to be especially destructive to cassava in Java, namely, *Leucopholis rorida* and *Lepidiota stigma,* the former causing the greater damage. In addition to an extended account of these two pests a list is given of insects of minor importance, together with a discussion of their bionomics.

The Mexican cotton boll weevil (*Ga. Bd. Ent. Bul. 39 (1914), pp. 3–24, pls. 7, fig. 1; 44 (1916), pp. 3–22, pls. 9, figs. 7*).—Popular accounts of this cotton pest are given. The first was prepared for the purpose of sounding a warning to the cotton growers of Georgia, while the second is a revised edition, giving information relating to the pest, which entered Georgia in the late summer of 1915.

The turnip gall weevil (*Jour. Bd. Agr. [London], 22 (1915), No. 9, pp. 884–887, pl. 1*).—This weevil (*Ceuthorhynchus pleurostigma [sulcicollis]*) is at times the source of considerable injury to the turnip and cabbage crops in England. It is widely distributed throughout the United Kingdom and is also well known on the Continent, being destructive in France, Russia, and Germany. Although its principal injury is to turnips and cabbage, mustard, charlock, rape, Brussels sprouts, savoy, and kohl-rabi are attacked.

The adults emerge from the pupæ in the spring and summer and oviposit on the roots of the food plants. On hatching out the young larva feeds on the roots, which causes the formation of galls. Upon completing their growth the larvæ leave the galls and pupate in the soil.

The corn and cotton wireworm in its relation to cereal and forage crops, with control measures, E. H. GIBSON (*U. S. Dept. Agr., Farmers' Bul. 733 (1916), pp. 7, figs. 3*).—A popular account of *Horistonotus uhleri,* based upon studies which extended over a period of three years. A report of studies of this species in South Carolina has previously been noted (E. S. R., 33, p. 158).

On the biology of the Gramang ant (Plagiolepis longipes), P. VAN DER GOOT (*Meded. Proefstat. Midden-Java, No. 19 (1915), pp. II+60; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 11, pp. 663, 664*).—The author presents a detailed account of the life history and bionomics of *P. longipes,* which is reported to attend plant lice and coccids on the branches of coffee, etc.

Transferring bees, F. E. MILLEN (*Michigan Sta. Spec. Bul. 76 (1915), pp. 16, figs. 9*).—This is the first of a series of bulletins with information relating to bee management.

Fourteenth annual report of the Illinois State Beekeepers' Association, compiled by J. A. STONE (*Ann. Rpt. Ill. Beekeepers' Assoc., 14 (1914), pp. 197,*

figs. 21).—This report contains the proceedings of the twenty-fourth annual session of the Illinois State Beekeepers' Association, held at Springfield, November 19 and 20, 1914 (pp. 25–99), and of the seventeenth annual convention of the Chicago-Northwestern Beekeepers' Association, held at Chicago, December 17 and 18, 1914 (pp. 101–175); the by-laws as adopted by and the minutes of the National Beekeepers' Association, Denver, Colo., in February, 1915 (pp. 176–188); etc.

Bramble bees and others, J. H. FABRE, trans. by A. TEIXEIRA DE MATTOS (*New York: Dodd, Mead & Co., 1915, pp. VIII+456*).—A popular treatise consisting of a translation of all the essays on wild bees from the author's Souvenirs Entomologiques, with the exception of those on mason bees previously noted (E. S. R., 32, p. 758). Observations of the bionomics of species of Osmia, leaf cutters (Megachile), cotton and resin bees (*Anthidium* spp.), and species of Halictus are given.

The hunting wasps, J. H. FABRE, trans. by A. TEIXEIRA DE MATTOS (*New York: Dodd, Mead & Co., 1915, pp. VIII+427*).—This popular treatise, which consists in large part of a translation of chapters on wasps from the author's Souvenirs Entomologiques, presents observations of the bionomics of species of Cerceris, Sphex, Ammophila, Bembex, etc.

A survey of the zoocecidia on species of Hicoria caused by parasites belonging to the Eriophyidæ and the Itonididæ (Cecidomyiidæ), B. W. WELLS (*Ohio Jour. Sci., 16 (1915), No. 2, pp. 37–59, figs. 33*).—This paper presents descriptions of the types of 2 eriophyid and 30 itonidid galls on hickory leaves. In addition, forms previously described and not seen by the author have been added to give completeness to the survey of the two groups of galls.

A new oat pest (Tarsonemus spirifex), the oat mite, T. A. C. SCHOEVERS (*Tijdschr. Plantenziekten, 21 (1915), No. 4, pp. 111–130, pls. 3, figs. 2; abs. in Rev. Appl. Ent., 3 (1915), Ser. A, No. 11, pp. 664, 665*).—Oats received in July from Almkerk were attacked by this mite. It has also been a source of injury to oats in some departments of France and has been found in Baden, Bavaria, and Mecklenburg. The damage done is very considerable, and at Wageningen 90 per cent of the haulms were more or less attacked.

A description of the mite and larvæ, with plates, by A. C. Oudemans forms a supplement to this paper (pp. 124–130).

The red spider on cotton and how to control it, E. A. MCGREGOR (*U. S. Dept. Agr., Farmers' Bul. 735 (1916), pp. 12, figs. 10*).—A general account based upon studies previously noted (E. S. R., 32, p. 251).

FOODS—HUMAN NUTRITION.

On the digestibility of bread.—I, Salivary digestion in vitro, J. C. BLAKE (*Jour. Amer. Chem. Soc., 38 (1916), No. 6, pp. 1245–1260, fig. 1*).—This paper is a report of experiments in vitro on the digestibility of bread, from which the following conclusions are drawn:

"The specificity and complexity of starches is confirmed. A number of polysaccharids are clearly recognized and differentiated, and the existence of two new ones indicated.

"The three principal ingredients of cereal starches are amylocellulose (the cell walls), amylopectin, and amylose.

"The amylose, contrary to the contention of . . . [others] passes through the stages of amylodextrin and erythrodextrin during salivary digestion, but these dextrins digest so rapidly that their presence in the digestion mixture can conveniently be demonstrated only when the enzym concentration is very low

(e. g., 1:99). Furthermore, an appreciable amount of achroödextrin enters the solution with ordinary concentrations of saliva.

"All of the dextrins under ordinary conditions disappear from the solution within 15 minutes, so that thereafter the further progress of the digestion can be followed by the polariscope, the only optically active substance then present being maltose if maltase has not been added from some outside source. As the amylose is all digested by this time, the further digestion represents action on amylocellulose and amylopectin and their products of hydrolysis.

"By slow digestion almost the entire amount of amylose present was obtained in solution as erythrodextrin at the end of 15 minutes. Hence under ordinary conditions the digestion of amylose must be almost instantaneous.

"Rose-amylose, derived from amylopectin, digests completely in four hours. This has usually been regarded as the end of starch digestion, the rose-amylose being confused with erythrodextrin.

"The amylocellulose (cell walls) digests only after more than 24 hours.

"The only differences observable in the rate of digestion of bread made from hard or soft wheat, and fermented more or less than usual, were due to the relative amounts of gluten present. When the gluten was broken down, the rate of digestion was sensibly the same.

"The cause of the greater palatability of home-baked bread was not discovered. Various pronounced effects due to fermentation by spoiled yeast were noted.

"The activity of amylases is not sensitive to small changes of temperature or of acidity produced by the organic acids found in bread; nor does their activity seem to be proportional to their concentrations. It would seem that under physiological conditions most of the amylose must be changed to dextrins in the mouth, and that these dextrins as well as most of the amylopectin and its products of hydrolysis must be digested in the stomach, whereas the digestion of the amylocellulose must take place for the most part in the intestine.

"Stale (air-dried) bread digests very slowly unless its gluten be completely broken down."

Milling and baking tests, J. A. Voelcker (*Jour. Roy. Agr. Soc. England, 76 (1915), pp. 333, 334*).—As a part of the study of the influence of magnesia on wheat, conducted at the Woburn Experimental Station of the Royal Agricultural Society, milling and baking tests were made upon four samples of wheat. Two of the samples were raised on new plats of ground and two on old plats, one of each pair of samples being raised on soil to which magnesia had been added. For commercial purposes no differences were noted in the baking quality of the samples.

Nutrition investigations upon cotton-seed meal, I, Anna E. Richardson and Helen S. Green (*Jour. Biol. Chem., 25 (1916), No. 2, pp. 307–318, figs. 5*).—Investigating the suitability of cotton-seed meal for human consumption, the authors report in this paper a number of feeding experiments to determine the efficiency of cotton-seed meal as a food for promoting the growth, development, and reproduction of the albino rat. The results indicate that "cotton-seed meal does not contain sufficient minerals for growth, is not actively toxic, contains efficient protein, and perhaps fat-soluble growth-promoting substances, similar to those of butter fat but in less adequate quantities."

Commercial possibilities of the goosefish, H. M. Smith (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 13 (1914), pp. 5*).—It is estimated that the fishermen of the Atlantic coast throw away annually about 10,000,000 of these fish, which, according to analyses of the edible portion, contain more protein than flounders

or cod and nearly as much as halibut. The goosefish is used extensively for food purposes in England, Scotland, and Germany. Recipes for the preparation of this fish are included in the circular.

Caviar: What it is and how to prepare it, L. Radcliffe (*U. S. Dept. Com., Bur. Fisheries Econ. Circ. 20 (1916), pp. 8, figs. 3*).—This pamphlet was issued especially to assist fishermen in making a better product.

Fermented milk in infant feeding, A. E. Mucklow (*Med. Rec. [N. Y.], 89 (1916), No. 26, pp. 1134–1137*).—Several formulas are given, together with directions and suggestions for their preparation.

Egg substitutes, E. Gerber (*Ztschr. Untersuch. Nahr. u. Genussmtl., 31 (1916), No. 2, pp. 45–54*).—Analyses are given of a number of egg substitutes. All of these preparations contained too little lecithin to be considered complete egg substitutes.

The use of wild plants as food by Indians, T. Wilson (*Ottawa Nat., 30 (1916), No. 2, pp. 17–21*).—A number of roots, shoots, leaves, and berries are described as having been used for food purposes by the Indians of British Columbia.

Dandelions as food, Lucile Brewer and Helen Canon (*Cornell Reading Courses, 5 (1916), No. 105, pp. 79–91, pl. 1, figs. 6*).—Directions are given for preparing dandelions for the table. Recipes are included.

The use of horse-chestnuts in human nutrition, H. Serger (*Chem. Ztg., 40 (1916), No. 31–32, pp. 221. 222*).—The fruit of the horse-chestnut was found to contain water, 40 per cent; protein, 5 per cent; fat, 2.5 per cent; sugar, 9 per cent; starch, 42 per cent, and ash, 1.5 per cent. By extraction with water and alcohol, the bitter principle was removed, thereby yielding a good grade of flour which was satisfactorily used in bread making.

The culture, extractive content, and preservation of edible fungi, R. Falck (*Ztschr. Forst u. Jagdw., 46 (1914), No. 11, pp. 639–645, figs. 4; 47 (1915), No. 10, pp. 583–601*).—Information is given regarding the culture, preparation, and preservation of edible fungi. The percentage composition of mushrooms and mushroom extracts is compared with that of meat and meat extracts.

Utilization of honey and wax, J. Tinsley (*West of Scot. Agr. Col. Bul. 69 (1916), pp. 63–72*).—Recipes are given.

[Food, drug, and dairy inspection] (*Ann. Rpt. Bd. Health Mass., 46 (1914), pp. 401–523, fig. 1*).—The work carried on under the state food and drug laws for the year ended November 30, 1914, is reviewed. The report of the analyst, H. C. Lythgoe, presents the results of the examination of 9,680 samples of foods and drugs, of which 7,385 conformed to existing standards. Reports are also included of the inspection of food products in cold storage, the inspection of slaughtered animals and meat products, and the sanitary inspection of dairies.

[Food and drug inspection], E. F. Ladd and Alma K. Johnson (*North Dakota Sta. Spec. Bul., 4 (1916), No. 4, pp. 81–96*).—Information is given regarding a number of samples of food products, toilet preparations, and patent medicines, including the text of a decision of the U. S. Supreme Court as to containers for lard.

Tenth biennial report of the dairy and food commissioner of the State of Oregon, J. D. Mickle (*Bien. Rpt. Dairy and Food Comr. Oreg., 10 (1912–1914), pp. 108, figs. 22*).—The work of the state dairy and food department for the two-year period ended September 30, 1914, is reviewed, and recommendations to the legislature are included. The work consisted chiefly of the inspection of dairies and other places where food was prepared or sold and the examination of samples of food products.

Preliminary report of the dairy and food commissioner for the year 1915, J. Foust (*Penn. Dept. Agr. Bul. 279 (1916), pp. 53*).—The work of the dairy

and food division is reviewed briefly and a summary is given showing the number of samples of food products analyzed, prosecutions terminated, etc.

Fifteenth annual report of the food and drug commissioner, G. G. Frary (*Ann. Rpt. Food and Drug Comr. S. Dak., 15 (1915), pp. 200*).—The work of the food and drug department for the year ended June 30, 1915, is reviewed. This included the examination of miscellaneous samples of foods, drugs, feeding stuffs, etc., and the sanitary inspection of hotels, restaurants, and rooming houses.

Biennial report of the dairy and food commissioner of Wisconsin for the period ending June 30, 1914, J. Q. Emery (*Bien. Rpt. Dairy and Food Comr. Wis., 1914, pp. 252, pls. 3, figs. 22*).—The work carried on during the period from July 1, 1912, to July 1, 1914, is reviewed at length. The report of the chemist, H. Klueter, gives the results of the examination of 1,428 samples of foods, drugs, paints, oils, etc. The report of the inspector of weights and measures is included in the publication.

In order to collect data for use in the enforcement of the net-weight law, shrinkage tests were made of flour, print butter, and cheese. Tables are given which show in detail the results of these tests.

The laws relating to the manufacture and sale of food products (*Salem, Oreg.: State Printing Department, 1915, pp. 81*).—This bulletin contains the texts of the laws relating to the manufacture and sale of food and dairy products, feeding stuffs, oils, and seeds. Regulations made by the dairy and food commissioner are included.

Unique nonrefrigerative methods of food, L. Lodian (*Refrigerating World, 50 (1916), No. 6, pp. 25–28, figs. 3*).—This article describes a number of methods for preserving food, such as air-drying, sun-desiccation, smoking, stringing, compression, etc.

What every housewife should know, W. L. Waldron (*Trenton, N. J.: [State, 1916], pp. 29, pl. 1*).—This pamphlet, issued by the Department of Weights and Measures of the State of New Jersey, contains general information regarding weights and measures, and gives hints useful in the purchasing of foods.

Rise in British food prices, H. L. Washington (*U. S. Dept. Com., Com. Rpts., No. 138 (1916), p. 990*).—The percentage increase in the prices of a number of common foodstuffs is noted.

Retail prices, house rent, and cost-of-living indexes, G. H. Knibbs (*Commonwealth Bur. Census and Statis. Aust., Labour Bul., No. 12 (1915), pp. 333–352*).—A compilation of statistical data.

A study on food and the fuel value of the dietary at the New York City Municipal Sanatorium, R. J. Wilson and W. L. Rathbun (*Jour. Amer. Med. Assoc., 66 (1916), No. 23, pp. 1760–1765*).—In this article descriptions are given of the methods employed in securing an adequate and economical diet for the patients and in reducing the amount of plate, table, kitchen, and ice-box waste.

A week's menu for an average Filipino family, Josefa Herrera (*Philippine Craftsman, 4 (1916), No. 8, pp. 514–517*).—Cost data are included.

The dietary of the field laborer in Spain (*Bol. Agr. Téc. y Econ., 8 (1916), No. 86, pp. 141–151*).—A summary and digest of data regarding the composition and fuel value of foods with respect to the selection of suitable menus for the laborer.

An experiment in the feeding of undernourished school children, Clara Schmitt (*Ed. Bi-Mo., 10 (1916), No. 5, pp. 379–390*).—This article gives the results of the feeding of 43 children, the food being served at the morning recess period.

The essential factors in a successful diet, E .V. McCollum (*N. Y. Med. Jour., 103 (1916), No. 18, pp. 838, 839*).—A summary and digest of data concerning the rôle played in nutrition by the vitamins, especially the substances known as fat-soluble A and water-soluble B, referred to in earlier work by the author.

Vitamins and complementary food ingredients, Boruttau (*Ber. Deut. Pharm. Gesell., 25 (1915), No. 9, pp. 468–486*).—The author discusses in this article the important part played by the vitamins in the deficiency diseases and the nutritional disorders of children.

Vitamins and nutritional diseases.—A stable form of vitamin, efficient in the prevention and cure of certain nutritional deficiency diseases, A. Seidell (*Pub. Health Rpts. [U. S.], 31 (1916), No. 7, pp. 364–370, fig. 1*).—A method is herein described for "obtaining a relatively concentrated and comparatively cheap form of vitamin suitable for studies on the prevention and cure of such human nutritional deficiency diseases as beri-beri, pellagra, infantile malnutrition, etc."

The process consists essentially in absorbing the vitamin contained in autolyzed yeast liquor by the selective action of colloidal hydrous aluminum silicate. As shown by experiments, the product is an activated solid, small doses of which exert both preventive and curative effects on pigeons receiving an exclusive diet of polished rice. The activated material is "practically tasteless and odorless, and aside from the vitamin which it contains is an absolutely inert substance which would produce no noticeable effects on passage through the body." It is estimated that 5 gm. of the activated solid per day, taken either in capsules or as an aqueous suspension, would supply the human body sufficient vitamin to prevent the occurrence of beri-beri.

The author suggests that the procedure for yeast can be used with slight modifications for estimating the vitamin content of various food products.

Observations upon the growth of young chickens under laboratory conditions, J. C. Drummond (*Biochem. Jour., 10 (1916), No. 1, pp. 77–88, pl. 1, figs. 7*).—Feeding experiments to determine the suitability of young chickens for the laboratory study of human deficiency diseases are reported. The results indicate that it is impossible, even by means of an adequate diet, to raise young chicks under artificial laboratory conditions to a satisfactory degree of development.

The growth of rats upon artificial diets containing lactose, J. C. Drummond (*Biochem. Jour., 10 (1916), No. 1, pp. 89–102, figs. 10*).—Feeding experiments with rats as laboratory animals are reported, from which the author concludes as follows:

"Lactose, prepared from milk, may contain traces of an impurity which acts as a growth-promoting accessory substance. This substance is soluble in water and alcohol, and is not destroyed by exposure to 100° for six hours.

"Before complete growth can occur in a young animal, the diet, besides being adequate as regards its proteins, carbohydrates, fats, and salts, must contain both fat-soluble and water-soluble accessory subtances. No growth is possible in the animals fed upon a purified diet which is entirely deficient in these accessory substances."

The action of Sardinian lactic acid on human metabolism, F. Fidanza (*Ann. Ig. Sper., n. ser., 25 (1915), No. 4, pp. 411–420*).—The data are reported of a metabolism experiment of eight days' duration, in which a normal man ingested large quantities of a Sardinian fermented milk called "gioddu."

The author concludes that on an exclusive diet of gioddu and bread it is possible to maintain the nitrogen equilibrium of the body for only a few days. The diet did not cause diuresis nor noticeably modify the acidity of the urine. The elimination of chlorids and phosphates was not affected, but the excretion

of sulphur compounds was gradually diminished. The body weight decreased 1.5 lbs., probably owing to the monotony of the diet.

Relative toxicity of substances found in foods, A. N. COOK and SYLVANNA ELLIOTT (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 503, 504*).—Experimental data are reported indicating the comparative toxicity of such substances as sodium benzoate, alum, caffein, carbolic acid, etc., in the case of laboratory animals (frogs and goldfish) living in solutions of these chemicals. The authors conclude that "experiments of this nature, at least upon animals so distantly related to man, do not furnish conclusive evidence of the effects of such substances upon the human system."

The fate of inorganic nitrogen in the metabolism of the dog, W. CALDWELL and H. R. S. CLOTWORTHY (*Biochem. Jour., 10 (1916), No. 1, pp. 14–25*).—A number of feeding experiments with laboratory animals (dogs) are reported, which were undertaken to determine whether the protein of food may be replaced by inorganic nitrogen in the form of ammonium salts. The animals received a basal ration consisting of potatoes, dog biscuit, flour, dried milk, salt, and water during a preliminary period until nitrogen excretion was approximately constant. The dogs then received, in addition to the basal ration, known amounts of different ammonium salts, the fate of which was investigated by urine analysis.

A uniform retention of the added nitrogen was not observed nor was the extra nitrogen always excreted in the same form. Although urea was sometimes found in the urine, the authors were not convinced that it was synthesized from ammonia nitrogen. In the authors' opinion the form in which the added nitrogen is excreted depends on the ammonium salt ingested, and apparently on the ions into which the ammonium salt is dissociated.

Nitrogen metabolism during pregnancy, K. M. WILSON (*Bul. Johns Hopkins Hosp., 27 (1916), No. 303, pp. 121–129, figs. 3*).—Observations were made on the nitrogen metabolism in three normal pregnancies, in one case from the tenth to the fourteenth week, and in two other cases for the last 133 and 101 days of the pregnancy and also for a short time in the puerperal period.

From the data reported it is evident that "in the perfectly normal pregnant woman, storage of nitrogen begins at a much earlier period than has hitherto been supposed; possibly the organism may acquire the capacity for storing nitrogen from the very beginning of the pregnancy. In the early months this storage is far in excess of the actual needs of the developing ovum, and the excess must be added to the general maternal organism. Storage of nitrogen continues throughout the entire duration of pregnancy, being most marked during the last few weeks, when the fetal needs are at a maximum.

"The nitrogen stored is greatly in excess of the actual needs of the developing ovum, so that, apart from the amount needed for the hypertrophy and development of the genitalia and breasts, a large proportion of the nitrogen stored is added to the general maternal organism as 'Restmaterial' . . . [although no positive statement is made] concerning the form in which this reserve is stored. . . . The nitrogen capital of the maternal organism is thus increased, though the reserve supply may possibly be entirely exhausted during the puerperium and period of lactation."

There was a relative, though not necessarily an absolute, increase in the percentage of urinary nitrogen excreted as amino acids, and also a tendency for the percentage of ammonia nitrogen to increase during the last weeks of pregnancy.

Acidosis in diabetes, R. T. WOODYATT (*Jour. Amer. Med. Assoc., 66 (1916), No. 25, pp. 1910–1913*).—The author summarizes and discusses in this paper information regarding the underlying causes of acidosis as related to the

metabolism of protein, fat, and carbohydrate in both diabetic and nondiabetic states.

Chemical means of protection against the cold, A. Montuori and R. Pollitzer (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), II, No. 11, pp. 543–548*).—The results of experiments with laboratory animals (dogs and guinea pigs) are reported, from which the authors conclude, in part, that the ingestion of alcohol or of tea does not appreciably protect the body from external cold. An infusion of coffee with the addition of a small amount of alcohol causes the body to react favorably (probably along the control nervous system).

ANIMAL PRODUCTION.

Studies on the nutritive value of straw materials, R. von der Heide, M. Steuber, and N. Zuntz (*Biochem. Ztschr., 73 (1916), No. 1–2, pp. 161–192*).—In these studies it was found that the crude fiber of straw is almost entirely digestible by horses, and that 1 kg. of straw material (with 20 per cent of molasses) so far as energy is concerned is of as much value as 2.55 kg. of hay or 0.92 kg. of oats. In straw feeding it was found feasible to feed 1 part of digestible protein to 14 parts of nitrogen-free material.

Chemical determination of the value of straw meal as feed material, W. Kerp, F. Schröder, and B. Pfyl (*Arb. K. Gsndhtsamt., 50 (1915), No. 2, pp. 232–262, pls. 6*).—An account of the composition, chemical characteristics, and nutritive value of oat, wheat, rye, and barley straw meals. It is concluded that for ruminants straw meal serves a useful purpose, but that for other animals, such as swine, it has little value. As a food for man, in the form of bread, straw meal is of value.

Feeding experiments with disintegrated rye straw, A. Stutzer (*Landw. Vers. Stat., 87 (1915), No. 2–3, pp. 228–236*).—In feeding experiments with sheep it was found that the digestibility of disintegrated rye straw was materially increased by dampening the material with dilute acetic acid. The dampened straw had a light brown color and an agreeable odor.

On the digestibility of pine needles, A. Stutzer and W. Haupt (*Landw. Jahrb., 48 (1915), No. 4, pp. 571–585*).—Experiments were conducted in feeding fresh and old pine needles to sheep.

It was found that fresh needles from the tree were unsuitable for feeding purposes, and after they were pulverized they were taken only unwillingly by the sheep. When fed in conjunction with potato meal and hay the organic matter of the needles was found to be 24 per cent digestible. After extraction by alcohol the digestibility coefficient of the organic matter was 35 per cent. The increase in digestibility after extraction by alcohol was especially noticeable in the crude fiber and nitrogen-free extract. The protein of the needles was partially digestible but decreased the digestibility of the proteins of the other feeds, as in experiments where turf straw was added. The depression of digestibility was 14 per cent, and after alcohol extraction 5 per cent.

The composition of fresh needles is given as follows: Organic matter 97.83, nitrogen 1.498, fat 2.49, nitrogen-free extract 38.76, fiber 47.22, and ash 2.17, and for the old needles 91.05, 0.85, 0.15, 40.81, 44.78, and 8.95, respectively.

Experiments with sphagnum turf as a feeding stuff, A. Stutzer (*Landw. Vers. Stat., 87 (1915), No. 2–3, pp. 215–227*).—In feeding experiments with sheep the author found that the dampening and disintegrating of sphagnum turf with dilute hydrochloric acid, which was later neutralized with sodium carbonate, materially increased the digestibility.

Cattle feeding.—XI, Winter steer feeding, 1914–15, J. H. Skinner and F. G. King (*Indiana Sta. Bul. 183 (1915), pp. 857–891, fig. 1; pop. ed., pp. 8, fig. 1*).—In these experiments seven lots of 10 steers each were fed 150 days, all the lots except lots 1 and 6 receiving shelled corn and 2.5 lbs. daily per 1,000 lbs. live weight of cotton-seed meal, and lot 1 receiving shelled corn, ground soy beans, 2.5 lbs. daily per 1,000 lbs. live weight, corn silage and oat straw; lot 2, clover hay; lot 3, alfalfa hay; lot 4, corn silage and clover hay; lot 5, molasses, corn silage, and clover hay; lot 6, shelled corn, molasses feed, corn silage, and clover hay; and lot 7, corn silage and alfalfa hay. Ten head of hogs followed each lot. The work was in continuation of that previously noted (E. S. R., 33, p. 371).

Part 1 is a comparison of corn silage and leguminous hay *v.* leguminous hay for fattening steers, involving lots 2, 3, 4, and 7.

"The addition of 24.94 lbs. of corn silage to a ration of shelled corn, cotton-seed meal, and clover hay decreased the average grain consumption 4.09 lbs. daily per head and the hay consumption 8.6 lbs. daily per steer. The addition of 28.36 lbs. of corn silage to a ration of shelled corn, cotton-seed meal, and alfalfa hay decreased the average grain consumption 4.09 lbs. daily per head and the hay consumption 10.23 lbs. daily per steer. The addition of corn silage to a ration consisting of shelled corn, cotton-seed meal, and clover hay decreased the rate of gain, while in a ration containing alfalfa hay the gains of the cattle were increased by the addition of corn silage. Corn silage in the ration decreased the cost of gain 4 cts. per 100 lbs. when clover hay was fed and $3.16 per 100 lbs. when alfalfa hay was fed. The addition of corn silage to the ration had on the average no effect on the finish of the cattle. The addition of corn silage to the ration decreased the loss per steer $2.80 when clover hay was fed and $12 when alfalfa hay was fed."

Part 2 is a comparison of ground soy beans *v.* cotton-seed meal for fattening steers, involving lots 1 and 4. The cattle fed ground soy beans made the more rapid and more economical gains and attained a higher finish. There was a greater pork production in the lot receiving cotton-seed meal.

Part 3 is a comparison of clover hay *v.* alfalfa hay as roughage for fattening steers, involving lots 2, 3, 4, and 7. The cattle fed shelled corn, cotton-seed meal, and clover hay ate the same quantity of corn and very nearly the same quantity of hay as the cattle fed shelled corn, cotton-seed meal, and alfalfa hay. Cattle fed shelled corn, cotton-seed meal, clover hay, and corn silage consumed the same quantity of grain but more hay and less silage than those fed a ration in which alfalfa hay was used instead of clover. Cattle fed clover hay as the only roughage made more rapid gain than those fed alfalfa hay. Cattle fed clover hay and corn silage made less rapid gains than those fed alfalfa hay and corn silage. Gains were more economical with clover hay than with alfalfa hay as roughage, and less economical with clover hay and corn silage than with alfalfa hay and corn silage as roughage. Cattle fed a ration of shelled corn, cotton-seed meal, and clover hay returned a loss, including pork, of $10.26 per steer against a loss of $13.07 when alfalfa hay replaced clover hay. A ration of shelled corn, cotton-seed meal, corn silage, and clover hay returned a loss, including pork, of $7.46 per head as compared with a loss of $1.07 per head when clover hay was replaced by alfalfa hay.

Part 4 is a comparison of cane molasses *v.* mixed molasses feed as supplements to rations for fattening cattle, and involving lots 4, 5, and 6. It was found that the substitution of a small quantity of feeding molasses for an equal quantity of corn in a ration of shelled corn, cotton-seed meal, clover hay, and corn silage had no appreciable effect on the consumption of con-

centrates but greatly increased the consumption of silage. The feeding of a proprietary molasses feed instead of cotton-seed meal had very little effect on the appetites of the cattle. The addition of molasses to the ration increased the rate of gain; the use of the molasses feed instead of cotton-seed meal resulted in a smaller rate of gain. Cattle fed a ration of shelled corn, cotton-seed meal, corn silage, and clover hay returned a loss of $7.46 per steer, including pork; cattle fed a similar ration with a part of the corn replaced by feeding molasses returned a loss of $6.19 per head; cattle fed a ration of shelled corn, proprietary molasses feed, corn silage, and clover hay returned a loss, including pork, of $12.91 per steer.

Dual purpose cattle, K. J. J. Mackenzie (*Jour. Bath and West and South. Counties Soc., 5. ser., 10 (1915–16), pp. 71–77*).—A general discussion of the economical advantages of dual purpose cattle, with data on feeding trials showing the gains and profits made by this type of steer.

Sheep feeding.—V, Fattening western lambs, 1914–15, J. H. Skinner and F. G. King (*Indiana Sta. Bul. 184 (1915), pp. 893–912, fig. 1; pop. ed., pp. 7, fig. 1*).—In these experiments nine lots of 25 choice Idaho lambs each were fed 90 days as follows, the first eight lots being fed in an open shed and the ninth lot in a barn: Lot 1, shelled corn and cotton-seed meal, 7:1, and corn silage; lot 2, shelled corn and oats, 2:1, and clover hay and corn silage; lot 3, shelled corn and clover hay; lot 4, shelled corn and alfalfa hay; lot 5, shelled corn and cotton-seed meal, 7:1, and oat straw and corn silage; lot 6, shelled corn, clover hay, and corn silage; lot 7, shelled corn and cotton-seed meal, 7:1, and clover hay and corn silage; lot 8, shelled corn and cotton-seed meal, 4:1, and clover hay and corn silage; and lot 9, shelled corn, clover hay, and corn silage. The work was in continuation of that previously noted (E. S. R., 33, p. 374).

Part 1 is a comparison of corn silage and clover hay as roughage for fattening lambs, involving lots 3 and 6. The addition of corn silage to the ration of shelled corn and clover hay did not affect the grain consumption, but 1.38 lbs. of silage replaced 0.69 lb. of clover hay in the daily ration per lamb. Lambs fed the ration of shelled corn and clover hay gained 27.4 lbs. per head in 90 days, as compared with 29.4 lbs. per lamb when corn silage was added. The addition of corn silage to the ration reduced the cost of gain 1.21 cts. per pound, slightly increasing the selling value of the lambs, and increased the profit 40 cts. per head.

Part 2 is a comparison of corn silage alone *v.* corn silage and dry roughage for fattening lambs, involving lots 1, 5, and 7. Lambs receiving no dry roughage did not consume so large quantities of grain as those fed some dry roughage. There was no difference in grain consumption between lambs fed silage and oat straw for roughage and those fed silage and clover hay for roughage. The silage consumption was somewhat in proportion to dry roughage consumed, the largest quantity being eaten when no dry roughage was fed and the smallest quantity when clover hay was fed. Gains made by lambs fed silage alone for roughage were 23 lbs. per head in 90 days at a cost of 6.74 cts. per pound; 27 lbs. at a cost of 6.21 cts. per pound when silage and oat straw were fed; and 30.1 lbs. at a cost of 7.37 cts. per pound when silage and clover hay were fed. The lambs in lot 1 were valued at 8.4 cts. per pound and returned a profit of 92 cts. per head; in lot 5, at 8.5 cts. per pound and returned a profit of $1.21 per head; and in lot 7, at 8.75 cts. per pound and returned a profit of $1.15 per head.

Part 3 is a comparison of clover hay *v.* alfalfa hay as roughage for fattening lambs, involving lots 3 and 4. The lambs of the two lots ate exactly the same quantities of both grain and hay, but the lambs fed shelled corn and clover

hay gained 27.4 lbs. per head as compared with 25.7 lbs. by lambs fed shelled corn and alfalfa hay. Larger quantities or feed per pound gain were required by the lambs fed alfalfa hay than by those fed clover hay. In lot 3, the gains cost 8.62 cts. per pound and the lambs were valued at 8.6 cts. per pound and returned a profit of 64 cts. per head. In lot 4, the gains cost 9.8 cts. and were valued at 8.5 cts. per pound, with a profit of 26 cts. per head.

Part 4 treats of cotton-seed meal as a supplement to rations for fattening lambs, involving lost 6, 7, and 8. The addition of cotton-seed meal to a ration of shelled corn, clover hay, and corn silage had practically no effect on the appetites of the lambs for either grain or roughage, but increased the rate of gain made by the lambs, slightly decreased the feed required to make a pound of gain, and increased the selling value of the lambs. The lambs in lot 6 made gains at a cost of 7.41 cts. per pound and returned a profit of $1.04 per head; those in lot 7 made gain at a cost of 7.37 cts. per pound and returned a profit of $1.15 per head; and those in lot 8 gained at a cost of 7.17 cts. per pound and returned a profit of $1.32 per head.

Part 5 treats of the value of oats for lambs, involving lots 6 and 2. The addition of oats to a ration of shelled corn, corn silage, and clover hay caused a decrease in grain and hay consumption. Gains were more rapid when no oats were fed. The cost of gain was 0.38 ct. per pound greater and the profit was 17 cts. per head less when oats were fed.

Part 6 is a comparison of open shed *v.* barn as shelter for fattening lambs, involving lots 6 and 9. The lambs fed in a well-ventilated barn ate the same amount of feed and made the same gains in weight as those fed in an open shed, but were of softer flesh and were valued at 0.1 ct. per pound less. The profit per lamb was 94 cts. per head in the barn as compared with $1.04 per head in the open shed.

Wool studies: Washing before shearing; time of shearing, J. W. Hammond (*Ohio Sta. Bul. 294 (1916), pp. 309–322, figs. 3*).—The object of this experiment was to determine the influence of washing sheep on the yield of grease and of scoured wool and on the rate of gain made by the sheep, and the influence of the time of shearing on the yields of grease and of scoured wool and on the rate of gain made by the sheep.

The experiment extended over a little more than two years, so that during its progress three clips of wool were removed, in 1911, 1912, and 1913. The treatment of the four lots, of 25 Merino sheep each, with respect to washing and time of shearing, was as follows: Lot 1, washed, shorn about April 12; lot 2 unwashed, shorn about April 12; lot 3, washed, shorn about June 1; and lot 4, unwashed, shorn about June 1.

A short time before being washed in 1913 one-half of the sheep in lots 1 and 2 were shifted from one lot to the other, and a similar shift was made in lots 3 and 4.

The sheep were washed in a stream of sufficient swiftness to supply an abundance of clean water. Each sheep was held in the stream separately and the dirt squeezed out of the wool by hand. An attempt was made to do a thorough job of washing, but, because of the density of the fleeces and the large amount of yolk they carried, it is probable that the washed wool still contained more foreign matter than is usually contained in washed wool from more open-wooled sheep. After the sheep were washed, from seven to ten days were allowed to intervene before they were shorn, to allow the wool to dry out thoroughly.

The scouring was done by the emulsion process, similar to that used commercially. The wool was put through three scouring liquors containing potash soap and potassium carbonate, of gradually diminishing strengths, and finally

through a rinse of clear, warm water. The wool was dried to a constant weight at a temperture of 150° F. both before and after scouring, to overcome any differences in moisture content that might exist on different days.

With respect to the effect of washing it was found that washed sheep produced 1.49 lbs. less grease wool per head when shorn April 12 and 2.64 lbs. less per head when shorn June 1 than did unwashed sheep shorn on the same dates. Washing the sheep had practically no effect on the amount of scoured wool produced or on the rate of gain made by the sheep. Wool shorn June 1, both washed and unwashed, shrank more in scouring than did wool shorn April 12. The data yielded by this experiment indicate that, in many cases at least, not sufficient premium is paid for washed wool to cover the cost of washing and the loss in weight of the wool. Since washing sheep does not improve the quality of the wool fiber and does not diminish the cost of scouring, the practice is not beneficial to the manufacturer.

As regards early *v.* late shearing, washed sheep shorn April 12 produced more grease wool than did washed sheep shorn June 1, while unwashed sheep shorn April 12 produced less grease wool than did unwashed sheep shorn June 1. This indicates that between these two dates there was an increase in weight of fleece due to the accumulation of a greater proportion of yolk or other foreign matter in the wool. Sheep shorn April 12, both washed and unwashed, produced slightly more scoured wool than did sheep shorn June 1. Sheep shorn April 12 made slightly greater gains than did sheep shorn June 1.

Trials with alfalfa as a hog feed. Some pasture crops for hogs, W. H. Peters and D. J. Geiken (*North Dakota Sta. Circ. 13* (*1916*), *p. 8*).—Three groups of three lots each of three and four pigs each, group 1, 3-month-old pigs, group 2, 7-month-old pigs, and group 3, mature brood sows, were fed from January 9 to March 13, 1915, with the following results:

Feed consumed, gains made, and cost of gains in hog-feeding tests.

Group.	Lot.	Feed used.	Gain per head per day.	Grain per pound of gain.	Cost per pound of gain.	Saving in cost per pound of gain.
			Pounds.	*Pounds.*	*Cents.*	*Cents.*
1	1	Barley 629, shorts 318, tankage 105 lbs	0.80	5.30	5.3	
1	2	Barley 526, shorts 263, tankage 88, dry alfalfa, 147 lbs	.78	4.47	4.8	0.5
1	3	Barley 541, shorts 270, tankage 90, steamed alfalfa 175 lbs	.80	4.50	4.9	.4
2	1	Barley 922, shorts 461 lbs	.66	8.32	8.3	
2	2	Barley 818, shorts 409, dry alfalfa 173 lbs	.77	6.25	6.6	1.7
2	3	Barley 874, shorts 437, steamed alfalfa 235 lbs	1.00	5.14	5.6	2.7
3	1	Barley 926, oats 463 lbs	1.08	6.78	6.8	
3	2	Barley 949, oats 474, dry alfalfa 507 lbs	1.18	6.42	7.5	.7
3	3	Barley 790, oats 395, steamed alfalfa 410 lbs	1.47	4.30	5.0	1.8

For the three lots where dry alfalfa hay was used it was put through a straw cutter and cut into one-half-inch lengths, and was fed by placing the dry hay in the troughs after the grain had been eaten at each feeding time. With the three lots where steamed hay was used it was put through the cutter, and then steamed for an hour or so before feeding by running live steam into a large can containing hay.

The results indicate that in order to get hogs started eating alfalfa hay in winter it is necessary to limit the grain to such an extent that the hogs must eat hay or go hungry. When handled in this way they will take very readily to the hay, and a limited amount of hay can be fed satisfactorily, securing as

good results and at less cost than where grain alone is fed. The greatest advantage to be gained in feeding hay in winter is a saving of grain and the lowering of the cost of feeding.

In another experiment, during the winter of 1915–16, 40 sows were fed alfalfa hay with a limited grain ration, while 10 others were fed the same grain ration without alfalfa. The idea was to get the sows to eat all the alfalfa they would and to feed just enough grain to keep them in satisfactory breeding condition. Observation of the sows was made during the winter months and during the month of March while they were farrowing. It was found possible to replace one-third of the grain ration for brood sows with alfalfa hay, 1.04 lbs. of alfalfa hay replacing 1 lb. of grain. The feeding of alfalfa afforded an excellent means of getting the sows to take more exercise than they do when fed grain alone. No trouble was experienced by any of the sows in farrowing, and the sows fed alfalfa hay farrowed as large, strong, and uniform litters of pigs as did the sows not receiving it. The sows fed alfalfa appeared to milk better and nurse their pigs a little better than did those not receiving hay. The results obtained in this trial indicate that it is practical and advisable to feed as much alfalfa hay to brood sows in winter as they will eat, so regulating the additional grain ration as to keep the sows in proper condition.

There is included a general discussion of alfalfa, sweet clover, rye, oats, barley, rape, and Canada field peas as pasture for hogs.

Concentrates for growing chicks and for laying stock, M. A. Jull (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 9, pp. 66–70*).—In experiments at Macdonald College three lots of 65 White Leghorn pullets were fed a basal ration of bran, corn meal, middlings, and oatmeal, 2 : 1 : 1 : 1, lot 1 receiving fish scrap and lot 2 a prepared mineral food in addition.

The birds in the fish-scrap pen ate 2 lbs. more feed than those in the check pen. Those in the prepared mineral-food pen ate the same amount as the check pen. The prepared mineral- and fish-scrap-fed pens laid about an equal number of eggs, the check pen not laying half as much as the other two pens.

In a second test to determine the value of dry ground-bone meal, fish scrap, a prepared mineral food, and beef scrap for growing chickens and winter egg production five pens were fed a basal ration as above with the respective supplements. The final order of merit, considering food consumed, weights, eggs laid, and profits realized, was beef scrap, prepared mineral food, fish scrap, bone meal.

This work brings out very strongly the value of mineral elements in a soluble condition in making an economical use of the feeds consumed in digestion, for in the second test less feed was taken to produce 1 lb. gain in live weight in the case where prepared mineral food was fed than with any of the other concentrates. Still, beef scrap ran the prepared mineral food very close in this respect, which may be due to the fact that the great success of animal feeds for growing chickens is because of the mineral elements found in them. The bone-meal concentrate was found in both tests to be of little nutritive value for young chickens, which confirms the belief that its mineral elements are in an unavailable state, especially for young poultry. It was found in the first test that a comparatively small percentage of mineral matter upset the birds, which made it imperative to drop the amount of prepared mineral food fed from 10 per cent to 5 per cent of the mash.

The birds receiving fish scrap did not lay tainted eggs, nor did their meat possess an unfavorable taste. Therefore, there is believed to be no danger from this source when 10 per cent of fish scrap is fed in the mash.

Skim milk for laying hens, H. R. Lewis (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 9, p. 72*).—In experiments conducted at the

New Jersey Experiment Stations two pens of 100 White Leghorn pullets each were fed the regulation ration, pen 1 receiving in addition an unlimited amount of sour skim milk.

Pen 1 laid during the first 12 months 12,044 eggs, or an average production of 34.4 per cent. The value of these eggs on the wholesale market was $375.04. The food cost, including skim milk, was $116.37, leaving a net profit above all food consumed of $258.67. Pen 2 laid during the first 12 months 8,382 eggs, or an average percentage production of 25.76, with a resulting value of eggs produced of $256.14. The cost of all food consumed in this pen was $99.21, leaving a resulting profit, above food, of $156.93.

In addition to this study four other tests with younger and older birds and with birds of different breeds were run simultaneously. The results of all these studies verify the differences shown in this particular instance, although in no case was the difference quite so pronounced. The conclusion reached from a careful analysis of these and other records of similar nature are as follows:

Sour skim milk has a very definite place in the nutrition of laying hens, being a splendid source of protein food, the element so necessary for the production of eggs. The returns measured in number of surplus eggs produced indicate that the sour skim milk has nearly five times the value paid for it. The feeding of sour milk kept the birds in better physical condition, lowering mortality and keeping them practically free from disease. It slightly increased the consumption of other parts of the ration, probably because the skim milk kept the digestive organs in splendid running order so that they were able to handle larger amounts, and it is thought that on a commercial basis this factor would appear more strongly than it did in this somewhat limited experiment. Egg producers can afford to pay from 40 to 80 cts. per 100 lbs. for skim milk. It can be fed in open pans, thus necessitating very little labor.

External characters as indications of egg production, O. B. Kent (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 8, pp. 63, 64*).—A study of the theory that late layers are late molters and that late molters molt rapidly gave a correlation of over 0.5 with a probable error of ± 0.02. The relation held true regardless of whether it was the first, second, third, or fourth year of production. None of the birds that were more than half way through their molt about October 1 were high producers and only a few late molters were low producers. Contrary to popular opinion the late molters molt rapidly and begin to lay as soon or sooner than the early molters. The medium molters begin to lay slightly ahead of the late or early molters. A very sightly better correlation was found between color of shank and egg production than between molting and egg production. This degree of pigmentation elsewhere is also an indication.

The health of the bird, as shown by the condition of the comb, is deemed a fair indication of egg production. When the comb is full-sized, red, pliable, and somewhat slippery the bird is usually laying The comb shrinks, becomes hard, light-colored, and rough as the bird stops laying. A series of observations made between pliability of comb and egg production gave a correlation of over 0.3 with a probable error slightly greater than ± 0.02. The pliability of the comb indicates whether the bird is laying at the time. Late laying tends to give high egg production.

The smoothness, pliability, and oiliness of the skin are also indications of egg production. A laying bird has a softer, smoother feeling than a nonlaying one.

The abdomen is a very good indicator of egg production. A bird, due to the yolks developing in the ovary and the increase in size of the oviduct, swells out its abdomen in preparation for a laying period. It makes little difference whether the distance between the pelvic arches, from the keel bone to the pelvic

arches, or from the keel bone to the base of the tail is used as a basis of selection, as these parts are very closely correlated in size. After a bird has stopped laying or as it gets ready to stop the abdomen shrinks. The actual distance between these parts depends on the size of the bird and the size of her egg, as well as the number of eggs about to be laid. The system is of value in telling what the bird may do for the next two or three weeks, or, by knowing that the bird is laying at certain times of year, it indicates high or low production.

Occurrence and significance of Bacterium pullorum in eggs, L. F. Rettger (*Jour. Amer. Assoc. Instr. and Invest. Poultry Husb., 2 (1916), No. 8, pp. 62, 63*).—The material reported is noted from another source (E. S. R., 35, p. 264).

DAIRY FARMING—DAIRYING.

The mineral metabolism of the milch cow; first paper, E. B. Forbes, F. M. Beegle, et al. (*Ohio Sta. Bul. 295 (1916), pp. 323–348*).—Two groups of 3 Holstein-Friesian cows each were fed during three periods of 19 or 20 days each, with 10-day intervals between periods, as follows: During the first period, group 1, corn, cotton-seed meal, timothy hay, and corn silage, and group 2, corn, cotton-seed meal, and clover hay; second period, group 1, corn, cotton-seed meal, clover hay, and corn silage, and group 2, corn, distillers' grains, clover hay, and corn silage; third period, group 1, corn, linseed meal, clover hay, and corn silage, and group 2, corn, gluten feed, clover hay, and corn silage.

It was found that liberal milk production on common practical winter rations fed in quantities sufficient to maintain the live weight and to cause regular nitrogen and sulphur storage caused consistent losses of calcium, magnesium, and phosphorus from the cows' skeletons. These losses occurred in spite of liberal supplies of these nutrients in the food. The limited response of the cows to an increase in the intake of these elements indicated that their utilization of these nutrients on a profitable plane of food consumption and milk production was surprisingly inefficient. The cause of this inadequate utilization of minerals, especially calcium, and the possibility of preventing losses of these nutrients stand in need of further investigation.

An extensive metabolism of silicon was demonstrated. An excess of inorganic acids over inorganic bases in a ration, due largely to the silicon of timothy hay, caused an acid reaction and an increase in the ammonia of the urine.

No important specific effects were observed of the nitrogenous concentrates, cotton-seed meal, linseed meal, gluten feed, and distillers' grains, on the digestibility of the rations in which they were fed.

The results of this study indicate that special attention should be given to the calcium, magnesium, and phosphorus contents of the rations of heavily-producing cows in order that the loss of these elements from the skeleton may be kept as low as possible. A liberal supply of foods which are rich in these elements should be allowed after the cow has ceased to produce abundantly, during the latter part of the period of lactation, in order to refund previous overdrafts before the birth of the next calf.

Silage made from oats and tares as a food for milking cows, A. W. Oldershaw (*Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 224–229*).—In this experiment six cows fed a daily ration of concentrated foods and chaff, supplemented by 60 lbs. of silage made from oats and tares, gave approximately the same quantity of milk as six cows fed a similar quantity of concentrated foods and chaff, supplemented by a daily ration of 60 lbs. of mangolds.

Value of the seven-day test, T. E. Woodward (*Hoard's Dairyman, 51 (1916), No. 25, p. 960, fig. 1*).—In a study of data collected from the advanced registry

records of the Holstein-Friesian Association comparing the reliability of seven-day and yearly tests, the author found that in general the yearly production varied with the record for seven days, but not in the same proportion. For instance, the cows yielding from 10 to 12 lbs. of fat in seven days gave on the average 423.71 lbs. in 365 days, while cows yielding twice as much in seven days gave only about one-half more in the course of a year. This indicates that the cows which produce the best during the first few weeks do not hold up so well later as do those which produce less during the early part of their lactation period. It appears that the higher the seven-day record the greater the variation in the 365-day test and the less accurate the seven-day test becomes as an indicator of the true production.

Influence of temperature on the proteolytic activity of lactic ferments, C. Gorini (*Atti R. Acad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), II, No. 8, pp. 369–376; abs. in Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 1, p. 143*).—The author has already pointed out (E. S. R., 34, p. 76) a difference in the organoleptic properties of peptonized whey produced by the same lactic ferment but developed at different temperatures. This difference led to the presumption of differences in the products of caseolysis.

The present investigations are a new analytic contribution to the demonstration already given by him as to the favorable influence exerted by low temperatures on the proteolytic activity of milk ferments. They further indicate that the lactic ferments should be especially studied in cultures kept at low temperatures. The number of lacto-proteolytic ferments capable of peptonizing casein in an acid medium is enlarged, and it is concluded that the optimum temperature is not the same for all the functions of a given microorganism.

The proteolytic indexes have been collected by the author in a table, and show the possibility of verifying, also analytically, not only the quantitative differences but also the qualitative differences in the proteolytic products of lactic ferments according to the temperature.

In the explanation of the greater caseolytic activity at low temperatures it must be considered that at this temperature the lactic ferments attack lactose more slowly. The milk attains later than at high temperatures a degree of acidity capable of attenuating and stopping the development of the bacteria, which thus can continue for a greater length of time to attack casein.

Experiments in Sweden on the prolonged pasteurization of milk, C. Barthel (*K. Landtbr. Akad. Handl. och Tidskr., 54 (1195), No. 7, pp. 610–648, figs. 2; abs. in Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Sci. and Pract. Agr., 7 (1915), No. 1, pp. 143–146*).—Trials with the "holder" process of pasteurizing conducted in Sweden have proved very satisfactory. It was found that milk pasteurized for from 20 to 30 minutes at 145° F. has no "cooked" taste, although this becomes noticeable at 149°. The cream also rises as readily in milk pasteurized at 145° as in unheated milk, but after pasteurizing at 149° it rises more slowly. Heating to 145° does not affect the protein or the soluble phosphates, but here again the influence of a temperature of 149° begins to make itself felt. The enzyms remain intact at 145° with the exception of amylase, which is destroyed at a relatively low temperature.

The experiments showed that pasteurized milk keeps from one to two days longer than ordinary milk, according to the temperature at which it is kept. The effect of pasteurization in destroying bacteria is also very satisfactory. When the milk after being heated is reinfected by the ordinary lactic ferments it becomes acid in the usual way, but naturally more slowly than unpasteurized milk.

The prolonged pasteurization of milk as carried out in the dairy industry, viz, heating for from 20 to 30 minutes at from 140 to 147.2° in apparatus maintaining it in continual motion, is deemed sufficient to remove all danger of the conveyance of tuberculosis by means of milk.

Studies on Swedish Emmental cheese and large-eyed Swedish cheese (Herrgårdsost), L. F. Rosengren and E. Haglund (*K. Landtbr. Akad. Handl. och Tidskr.*, *53* (*1914*), *No. 7, pp. 485–526, figs. 8*).—In these studies a marked difference was found between the Swedish Emmental and Herrgård cheese: Much the larger amount of amino acids was formed in the Swedish Emmental cheese during ripening.

In both cheeses the volatile fatty acids were formed mostly from acetic and propionic acids. The content of such acids was generally smaller in cheese with weak eye-formation than in cheese with strong eye-formation. The sweet-bitter cheeses contain an abnormal quantity of butyric acid. A large amount of salt decreased the content of volatile fatty acids substances in the Swedish Emmental cheese, and the addition of saltpeter decreased the content in both cheeses, especially the propionic acids. The addition of saltpeter to the milk often gave a taste of saltpeter to the cheese and spoiled its color, but can control too rapid fermentation.

Cheese making, C. L. Stahl (*Va. Dairy and Food Div. Bul. 59* (*1916*), *pp. 27, figs. 7*).—This deals with methods and costs of cheese making.

VETERINARY MEDICINE.

Annual report of the Bengal Veterinary College and of the Civil Veterinary Department, Bengal, for the year 1914–15, A. Smith and P. J. Kerr (*Ann. Rpt. Bengal Vet. Col. and Civ. Vet. Dept., 1914–15, pp. 4+III+7+VIII+4*).—This is the usual annual report (E. S. R., 32, p. 678).

Annual report on the Punjab Veterinary College, Civil Veterinary Department, Punjab, and the Government Cattle Farm, Hissar, for the year 1914–15, Pease, J. Farmer, and R. Branford (*Ann. Rpt. Punjab Vet. Col. and Civ. Vet. Dept., 1914–15, pp. III+2+17+XVII*).—This is the usual annual report (E. S. R., 32, p. 272).

The utilization of sucrose and the inverting power of the blood serum after parenteral administration of sucrose, S. Kuriyama (*Jour. Biol. Chem.*, *25* (*1916*), *No. 3, pp. 521–547*).—"In correspondence with earlier observations . . . sucrose, administered parenterally to dogs, was not eliminated quantitatively in the urine. The amount recovered varied considerably, averaging 76 per cent when sucrose was injected in doses of from 0.4 to 0.9 gm. per kilogram of body weight. The elimination was usually concluded within 24 hours. The degree of utilization was essentially the same for the different paths of parenteral introduction of the sugar. The apparent utilization of a small part of the sucrose, as judged by its failure to be excreted by the kidneys, may be due to the presence or rapid production of sucrose in the blood. . . .

"Experiments in vitro showed that the inverting power of active yeast or intestinal extracts was not lost in the presence of defibrinated blood or serum, although it was considerably decreased. Addition of acid facilitated the invertin reaction and therefore was carried out in some of the experiments with serum.

"That the activity of sucrase is retained in the circulation itself was shown by the results of injecting solutions of active yeast invertin; for under such conditions injected sucrose failed to reappear in as large amounts as usual. The better utilization was not due to any failure of the kidney functions in excret-

ing sucrose. The invertin can be demonstrated in the blood after injection of such an enzym extract. It soon disappears from the circulation, and can no longer be detected in the serum at the end of from 20 to 24 hours. The better utilization of sucrose thereupon does not continue to be manifested. Invertin was not excreted into the urine. . . .

"Examination of the serum of dogs and rabbits after repeated parenteral injections of sucrose in both small and large doses has uniformly failed . . . to demonstrate the presence of invertin in amounts detectable by the methods employed. Glucose was likewise unaltered by the sera of the animals examined."

See also a previous note by Röhmann (E. S. R., 34, p. 675.)

The intravenous injection of magnesium sulphate for anesthesia in animals, J. Auer and S. J. Meltzer (*Jour. Expt. Med., 23 (1916), No. 5, pp. 641–653*).—Experimental data submitted show that "by the intravenous injection of fourth-molar magnesium sulphate into dogs at a certain rate, a stage can be reached where the abdominal walls are completely relaxed and when section of the abdomen and stimulation of sensitive parts of the parietal peritoneum do not produce pain or elicit any reaction of the animal. At the same time spontaneous respiration may still be maintained within normal limits and the lid reflex be fair or even normal. In this stage intratracheal intubation for artificial respiration can be easily accomplished. This stage may be attained in 12 to 14 minutes when the rate of injection is about 3 cc. per minute.

"When this stage is once attained the rate of injection should gradually be reduced, otherwise, sooner or later, spontaneous respiration will be abolished, and by a further maintenance of the rate of injection all the skeletal muscles may become paralyzed. When the injection of magnesium is continued for a longer period the paralytic effects of the magnesium injection will set in, even when administered at a slow rate.

"The paralysis of the respiratory function is readily met by intrapharyngeal insufflation, which is easily executed even without training in this procedure, or by the method of intratracheal insufflation, if executed by one trained in its management. When the respiration of the animal is accomplished by insufflation, the paralytic effect of the magnesium may be abolished fairly rapidly by an intravenous injection of about 10 cc. of an eight-molar calcium chlorid solution; or it may disappear slowly, after the infusion of the magnesium solution is discontinued for some time. The latter mode of disappearance may be favorably accelerated by an intravenous infusion of 60 to 100 cc. of a fourth-molar solution of sodium sulphate."

It is indicated that the production of anesthesia by the intravenous injection of magnesium should not be undertaken unless an apparatus for intrapharyngeal insufflation is at hand. Calcium chlorid should not be employed in cases in which the subject shows cardiac insufficiency, nor should the method of producing the anesthesia be used in such instances.

Some fallacies regarding phenol, M. I. Wilbert (*Pub. Health Rpts. [U. S.], 31 (1916), No. 17, pp. 1046–1051*).—Experiments in which the germicidal value of mixtures of phenol and ethyl alcohol and of phenol and glycerin was determined are reported, together with experiments on the effect of ethyl alcohol or glycerin on the toxicity of phenol, as shown by inoculations into white mice.

From the experimental work it is concluded that "the addition of ethyl alcohol to phenol not only increases the solubility of phenol in water, but also increases rather than diminishes the antiseptic value of the resulting solution. Ethyl alcohol can be used to advantage as a substitute for glycerin in making antiseptic solutions of phenol. . . . The addition of ethyl alcohol to solu-

tions of phenol in water does not in any way inhibit the toxic action of phenol, but rather tends to facilitate absorption and thus hasten death."

The conditions and characters of the immunity produced in the guinea pig by instillation of horse serum into the nose, H. SEWALL and C. POWELL (*Jour. Expt. Med., 24 (1916), No. 1, pp. 69–86*).—The results of the experimental work submitted are summarized as follows:

"Normal guinea pigs treated by from four to six instillations of horse serum into the nose on alternate days become either hypersensitive or refractory to an intravenous injection of 0.38 cc. of serum given 16 days after the last instillation. If the amount of serum in each instillation is as much as 0.2 cc., anaphylactic death is caused by the toxic injection. If the amount of serum in each instillation is reduced to 0.04 cc., the first intravenous injection is without marked effect, and a second injection and subsequent injections of the same amount of antigen are well tolerated in about half the cases.

"The effect produced by a given dose of serum, whether protective or anaphylactic, depends probably upon the extent of contact with the mucous membrane of the nose. Guinea pigs which, after nasal treatment, have become tolerant to a definite maximum intravenous injection of the antigen appear to increase the degree of their tolerance, at least up to a resting period of more than four months. The same does not hold in animals immunizd by the peritoneal route.

"The first two or three instillations of a series probably determine the biologic character, whether of hypersensitiveness or hyposensitiveness, of reaction toward the serum. It is probable that, contrary to the case in parenteral sensitization, hypersensitiveness and protection, respectivly, set up by nasal instillations and not followed by parenteral injections, gradually disappear in about 50 to 100 days. We have failed in attempts to eliminate hypersensitiveness, due to subcutaneous injection of serum, by nasal instillations which would protect the normal animal from the development of anaphylaxis."

From the results it is indicated that "the peculiar value of rest in the treatment of infection depends upon the fact that absorption of minimal amounts of toxic matter produces a positive protective reaction in the organism, while the absorption of larger amounts renders the cells hypersensitive. The biologic response to the intoxication is probably chiefly determined within the first 48 hours of absorption, and, therefore, rest at the beginning of an infective process has preponderant prophylactic value."

It is indicated that the principles of prophylaxis evolved under these relatively simple conditions should be applied in the study of infectious diseases.

Immunity conferred by the transfer of immune and of mixed immune and sensitized serums, H. SEWALL, W. C. MITCHELL, and C. POWELL (*Jour. Amer. Med. Assoc., 67 (1916), No. 2, pp. 95–98*).—The work reported was undertaken to discover, if possible, whether the blood serum of guinea pigs, rendered immune to considerable intravenous injections of horse serum by a preceding course of nasal instillation of the serum, has a different biological effect from the serum of highly sensitized animals when injected intraperitoneally into normal guinea pigs.

It is deemed that the experimental results reported, taken in connection with earlier findings (see the previous abstract) justify the following tentative conclusions:

"A foreign protein injected into a normal animal sets up reactive processes leading to the formation, in this field, of two antibodies having opposite characters; one tends to induce, and the other to avert, the establishment of the anaphylactic state. Serum containing an excess of the anaphylactic antibody, when transferred to normal animals, renders them, as is well known, passively

anaphylactic. Serum containing a sufficient excess of the 'protective' antibody, when transferred to normal animals, initiates in them the phenomena of active immunity. Mixtures of the two types of serum seem still more effective in conferring immunity. The metabolism of the body cells is specifically modified by combination with these antibodies in such a way as to give rise to hypersensitization on the one hand or to active immunity on the other."

Serum antitrypsin during inanition.—Studies on ferment action, XIX, J. W. Jobling and W. Petersen (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 3, pp. 219–234, figs. 5*).—During the fasting period a marked decrease in the amount of serum antitrypsin is evident. The lowering of the antitryptic titer is accompanied by an increase of nonprecipitatable nitrogen in the serum, which indicates a protein intoxication. Such periods of intoxication are followed by a rise in antitryptic titer. Through this increase of antitrypsin a further protease action of the serum can be overcome. The premortal nitrogen excretion very shortly follows the period of lowest antitryptic titer and subsequent increase in nonprecipitatable nitrogen in the serum.

Death by starvation is caused by an intoxication from split protein products. The experiments reported confirm the conclusion of Schulz that the influence of the metabolic processes during the starvation period is dependent not only on the quantity of fat but also on an autointoxication resulting from the altered balance of the ferment-antiferment system. A marked leucocytosis is noted in the dog at such times of intoxication. Diluting the serum during intoxication does not prevent death.

Protein metabolism seems to be markedly influenced by the amount of antitrypsin in the blood. If the titer is high little nitrogen is excreted. If the titer is low, however, a relatively large excretion takes place.

See also a previous note (E. S. R., 32, p. 678).

The occurrence of the coagulation reaction in anaphylactic shock and in poisoning with anaphylatoxin, L. Hirschfeld and R. Klinger (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 24 (1915), No. 3, pp. 235–257*).—In the blood of animals (rabbit, guinea pig, and dog) which had been actively or passively sensitized a positive coagulation reaction of the blood set in a few minutes after the reinjection of antigen, even though previously treated with various organ extracts (cytozym emulsions). The same change was noted after the injection of anaphylatoxin into guinea pigs. The blood of these animals thus shows the characteristic property previously encountered only in the case of syphilitics.

Vaccine treatment, L. Hektoen (*Jour. Amer. Med. Assoc., 66 (1916), No. 21, pp. 1591–1594*).—"If the presentations in this paper are trustworthy, it may be concluded that the general results so far from the routine use of commercial vaccines, polyvalent and mixed, have no value as evidence for or against the curative usefulness of vaccine treatment, and hence no value, either, with respect to the soundness of the theory on which vaccine treatment primarily has been developed.

"In subacute and chronic localized infections, the results appear to indicate that specific vaccines properly and skillfully used have value, quite likely because they increase the production of specific antibodies as demanded by the theory, but probably also because they stimulate leucocytic and other activities.

"In typhoid fever, and possibly also in other infectious diseases, the intravenous injection of specific vaccines and also of other substances may induce crisis and prompt recovery. The mechanism of this action is not fully understood; but as it involves something more than or different from specific

stimulation of the production of antibodies, it can not be interpreted in terms of the current conception of the action of vaccines. We are entering, therefore, a new and interesting development in the study and treatment of infectious diseases."

The etiology of rat-bite fever, F. G. BLAKE (*Jour. Expt. Med., 23 (1916), No. 1, pp. 39–60, pls. 7, fig. 1*).—"Rat-bite fever is a specific infectious disease following the bite of a rat. It occurs in Asia, Europe, and America. The etiological organism is *Streptothrix muris ratti*, first described by Schottmüller in 1914. His observation is confirmed by the isolation of an identical streptothrix in the case here reported. Invasion of the blood stream by *S. muris ratti* occurs in rat-bite fever. The case here reported developed a powerful agglutinin for *S. muris ratti*. Pathological changes occur in the myocardium, kidneys, liver, and adrenals showing areas of degeneration and infiltration with polynuclear leucocytes, lymphocytes, plasma cells, and endothelial cells. Ulcerative endocarditis may occur in rat-bite fever and be caused by the *S. muris ratti*."

The etiology and treatment of rat-bite fever, W. TILESTON (*Jour. Amer. Med. Assoc., 66 (1916), No. 14, pp. 995–998, figs. 4*).—"In a typical case of rat-bite fever, organisms were found in the blood, closely resembling the *Streptothrix muris ratti* of Schottmüller and Blake. They were present in each febrile paroxysm and absent in the intervals. They were readily demonstrated by dark-field illumination, but with difficulty by staining methods, probably on account of a strong tendency to fragmentation. Blood cultures and inoculations of animals with the blood were negative. The administration of salvarsan was followed by immediate cessation of the paroxysms. An abortive case of rat-bite fever is reported."

Chinese animal hides, skins, and bristles, J. R. SHAND (*Amer. Jour. Vet. Med., 11 (1916), No. 8, pp. 609–615*).—This article briefly considers the sanitary conditions to be contended with when hides and skins are imported into the United States from China, and suggests remedies for handling the situation. The methods used for disinfecting the hides and other material in China are briefly discussed.

On the resistance of Bacillus anthracis spores to high temperature, R. H. MALONE and ELEANOR SHANLY (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 85–88*).—The results obtained in the experiments here reported have led the authors to conclude that there is no correlation between any one growth characteristic and the heat resistance of the spores, that strains of *B. anthracis* and individual spores of the same strain vary in their heat-resisting power, and that there is no specific thermal death point for anthrax spores.

Experiments upon the transmission of rinderpest, A. R. WARD, F. W. WOOD, and W. H. BOYNTON (*Philippine Bur. Agr. Bul. 30 (1914), pp. 31, pls. 2, figs. 6*).—Previously noted from another source (E. S. R., 31, p. 677).

The development of ideas regarding the preparation and use of antirinderpest serum, A. R. WARD (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 4, pp. 456–470, figs. 3*)—This article discusses the development of the serological treatment of the disease and reports some results obtained in the Philippine Islands by the use of serum from animals that had merely been immunized in the field, and not hyperimmunized. A bibliography of 24 references to the literature cited is appended.

On the heat resistance of bacterial spores, with a consideration of the nature of the spore-like bodies seen in Bacillus tuberculosis and allied forms, ELEANOR SHANLY (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 121–140, pl. 1, fig. 1*).—This paper includes a discussion of the

method employed, cultures made use of, the heat resistance, and the significance of the granules in tubercle and allied bacilli, the thermal death point of the presumed spores of *B. tuberculosis*, etc. It was found that many forms which will survive exposure for 15 minutes at 80° C. are killed by exposure for half an hour, and yet more by exposure for an hour.

On the pathology of bovine actinomycosis, a preliminary report, F. Griffith (*Jour. Hyg.* [*Cambridge*], *15* (*1916*), *No. 2, pp. 195–207*).—Previously noted from another source (E. S. R., 34, p. 782).

The Bacillus enteritidis as the cause of infectious diarrhea in calves, K. F. Meyer, J. Traum, and C. L. Roadhouse (*Jour. Amer. Vet. Med. Assoc., 49* (*1916*), *No. 1, pp. 17–35*).—The authors' investigations, conducted at the laboratory of the University of California, have led to the conclusion that *B. enteritidis* is responsible in the United States for certain forms of infectious diarrhea in calves. It is pointed out that our knowledge concerning *B. enteritidis* and paracolon infections, especially in bovines in this country, is very limited. While the observations do not permit definite conclusions as to the prevention and treatment of infectious diarrhea of calves after the first few days of their lives, they do, however, suggest that when milk of an unknown quality is fed it should first be pasteurized. "Symptomatic treatment is as a rule not satisfactory and not much can be expected from either serum or serum and bacterin treatment unless the specific organism is employed in the production of these biologic products."

Observations of keratitis infectiosa of the reindeer, B. R. Avid (*Deut. Tierärztl. Wchnschr., 23* (*1915*), *No. 28, pp. 226–229; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 9, pp. 1209, 1210*).—A summary of investigations of a disease of reindeer found to be identical with keratitis infectiosa of cattle.

Coccidiosis of Egyptian sheep and goats, Mohammed Askar (*Agr. Jour. Egypt, 5* (*1916*), *No. 1–2, pp. 50–62, pl. 1*).—The discovery of this disease in Cairo abattoirs is recorded and a brief account is given of the causative agent.

Hog cholera: Its control and eradication, O. E. Strodtman and W. G. West (*Kans. Live-Stock Sanit. Dept., Farmers' Bul. 1* (*1916*), *pp. 16*).—This discusses the subject under the heads of causes, symptoms of hog cholera, treatment of infected and exposed herds, methods of using the serum, manner of treatment, and prevention. The symptoms and treatment of lungworms and bowel worms in hogs are also briefly discussed.

Production of clear and sterilized antihog-cholera serum, M. Dorset and R. R. Henley (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 9, pp. 333–338*).—For the production of clear and sterilized antihog-cholera serum the authors have devised the following procedure:

Bean extract for agglutinating the blood corpuscles is prepared by soaking 100 gm. of coarsely ground white navy beans for one hour in 500 cc. distilled water, with occasional shaking. The pulp is then strained through cheese cloth or cotton and mixed with powdered kieselguhr and filtered until clear. The clear, filtered extract is then passed through a bacteria-proof filter of infusorial earth.

In preparing the defibrinated blood for centrifugalization 1 cc. of the sterile bean extract is added to each 100 cc. of the cool defibrinated blood. The mixture is allowed to stand until agglutination is clearly evident. One gm. of finely powdered sodium chlorid is added and stirred until dissolved. The mixture of defibrinated blood, bean extract, and salt is allowed to stand for about 15 minutes, placed in suitable containers, and rotated in a centrifuge for 15 minutes at a speed sufficient to produce in the cups a precipitating force equal to approximately 1,700 times gravity. The serum may then be poured from the

cups into suitable containers and sterilized in a container which is surrounded by a jacket of water. The temperature of the water in the outer jacket at the beginning of the heating should not exceed 63° C. The serum in the inner container is slowly stirred during the heating process, care being taken to see that the temperature of the serum does not fall below 60° nor rise materially above it. Continuous heating for 30 minutes at 60° is required. After the sterilization the serum is rapidly cooled, and one part of a 5 per cent solution of phenol added to nine parts of the serum. After the phenol has been added a slight precipitate may at times form in the serum, and it is therefore desirable to allow several days to elapse between the addition of the phenol and the final filtration through infusorial earth.

By the new procedure yields of from 70 to 74 per cent of the perfectly sterilized serum were obtained.

"There seems to be no reason why the process should not be entirely satisfactory for use in the practical production of antihog-cholera serum. There appears to be little or no loss in antibodies; the serum secured is generally clear; and it may be removed from the agglutinated cells easily by pouring from the cups. The method also would seem to tend toward a certain concentration of the antibodies of the blood, and it is also to be recommended on account of the fact that it results in a large yield of serum.

"The fact that this serum may be heated for half an hour at 60° without noticeable impairment of its potency is of much practical importance because there is thus afforded a ready means for safeguarding it against infection with the virus of the foot-and-mouth disease."

Ascariasis in the horse and swine, H. THUM (*Ztschr. Tiermed., 18 (1915), No. 11–12, pp. 503–528; abs. in Cornell Vet., 5 (1916), No. 4, pp. 205–209*).—A report of observations relating to *Ascaris megalocephala* in the horse and *A. lumbricoides* in swine.

Contribution to the study of parasitic affections of the horse.—A clinical study of equine strongylidosis, G. LENEVEU (*Rev. Gén. Méd. Vét., 24 (1915), No. 288, pp. 593–612; abs. in Jour. Amer. Vet. Med. Assoc., 49 (1916), Nos. 1, pp. 102–106; 2, pp. 161–163*).—This is a compilation of information relating to the life history of the nematodes of the genera Strongylus and Cylicostomus that are parasitic in the horse, and to the lesions, symptoms, etc., of which they are the source. These forms occur endemically in various parts of France and especially in Normandy.

The poisonous effects of the rose chafer upon chickens, G. H. LAMSON, JR. (*Science, n. ser., 43 (1916), No. 1100, pp. 138, 139*).—Substantially noted from another source (E. S. R., 34, p. 655).

RURAL ENGINEERING.

Engineering geology, H. RIES and T. L. WATSON (*New York: John Wiley & Sons, 1915, 2. ed., enl., pp. XXVII+722, pls. 104, figs. 249*).—This is a second and enlarged edition of this book (E. S. R., 32, p. 784), to which a chapter on historical geology has been added.

Water supply, sewerage, and drainage department [Western Australia], third annual report, year 1914–15 (*West. Aust. Water Supply, Sewer., and Drain. Dept. Ann. Rpt., 3 (1914–15), pp. VIII+111, pls. 36*).—The activities and expenditures of the department for the year ended June 30, 1915, are reported, including data on irrigation, drainage, and rural water supplies and related hydraulic experimental data.

Water resources of the State of Oregon, J. H. LEWIS (*Off. State Engin. Oreg. Bul. 4 (1915), pp. 353, figs. 18, pl. 1*).—This report, prepared in coopera-

tion with the U. S. Geological Survey, is a summary of the available information relating to the water resources of Oregon.

Report of progress of stream measurements (hydrometric surveys) for the calendar year 1914, F. H. Peters et al. (*Dept. Int. Canada, Sess. Paper No. 25c (1915), pp. 508, pls. 20, figs. 5*).—This report contains the results of measurements of flow made on streams and irrigation canals and ditches in Alberta and Saskatchewan during 1914.

Water samples, L. Heimburger (*Fla. Quart. Bul. Dept. Agr., 26 (1916), No. 1, pp. 147–152*).—This section contains the results of analyses of 25 samples of water from different sources in different parts of Florida.

Status of activated-sludge sewage treatment, G. T. Hammond (*Engin. News, 75 (1916), No. 17, pp. 798–801, figs. 10*).—From the results observed on inspection of five working scale plants, it is concluded that the activated-sludge process is not as yet out of the early experimental stage and that no forecast as to its value for sewage treatment is now justified. The greatest problem appears to be the economical production of a sludge of such a character as to be of value as a fertilizer base. As an aid in solving this problem the reduction of the volume of sludge-making materials by screening preliminary to activation is recommended.

Reclamation Board Act of the State of California as in effect on and after August 8, 1915 (*Sacramento, Cal.: State Reclam. Bd., 1915, pp. IV+41*).—The text of the act is given.

Hydraulic and excavation tables, A. P. Davis (*U. S. Dept. Int., Reclam. Serv., Hydraulic and Excavation Tables, 1913, pp. 147, figs. 2*).—Tables intended for the use of engineers engaged in the design, construction, and operation of irrigation works under the U. S. Reclamation Service are given.

Harper's hydraulic tables for the flow of water in circular pipes under pressure, timber flumes, open channels, and egg-shaped conduits, J. H. Harper (*New York: D. Van Nostrand Co., 1916, pp. 192, figs. 39*).—This handbook contains formulas and tables for flow of water in circular pipes running full, rectangular channels, open trapezoidal channels, and egg-shaped conduits, together with a large amount of accessory information.

The discharge from vertical pipes, C. E. Grunsky (*West. Engin., 7 (1916), No. 4, pp. 182, 183, fig. 1*).—A simple formula for computing the flow of water from vertical pipes, which is especially applicable to computing the discharge from artesian wells, is given as follows: $D=\frac{10d\sqrt{h_0^3}}{\sqrt{1+2.525\left(\frac{h_0}{d}\right)^2}}$. D=discharge in cubic feet per second, d=inside diameter of the casing in feet, and h_0=height in feet to which water rises in the center over the top of the casing.

Irrigation module devised for constant flow, J. Barieau (*Engin. News, 75 (1916), No. 17, pp. 806, 807, fig. 1*).—This device, consisting essentially of a cast-iron base and a number of galvanized sheet-iron cylinders, is described and illustrated in section. It is adjustable and can be designed for any variation in canal level.

Small irrigation canals lined with concrete to prevent seepage water loss, C. E. Edwards (*Engin. Rec., 73 (1916), Nos. 16, pp. 508–510, figs. 2; 17, pp. 539–541, fig. 1*).—This article gives the details of construction and cost of work on the Okanogan Irrigation Project in Washington. It was found that seepage losses were reduced from 51 to about 15 per cent of the total water received at the headworks.

"Part of the lining has been in use for four seasons and has given good service and shows no signs of wear. Up to date it has required no expense

for maintenance, except at a few places on some of the first work where drainage inlets were not constructed at the time the lining was placed. The friction factor for this kind of lining as determined from experiments varies from $n=0.01$ for canals having a straight alignment and perfectly free from shifting sand and pebbles on the bottom to $n=0.015$ for canals having numerous curves and a limited amount of moving sand along the bottom. No trouble has been experienced on account of expansion or contraction injuring the lining, even when the water is rotated and the canal is dry half the time during the summer."

Comparison of wood and concrete for use in irrigation structures, S. T. Harding (*Engin. and Contract., 45 (1916), No. 15, pp. 340–342*).—This report deals with the factors involved in a choice between concrete and wood for irrigation structures.

It is concluded "that no general conclusions can be drawn as to the most economical type of construction. For any particular project where the construction costs can be estimated and the other factors, such as financial conditions of the constructing organization, rate of interest, certainty as to type of structure desired, and permanence of its location, can be given proper weight, a decision can be made. Under usual conditions concrete will be the preferable material if the capitalized cost of service alone is considered. The other factors are, however, more usually such as to incline the choice toward wood for first construction, except for the larger and more important structures. That the capitalized cost is being given more consideration and that many systems are reaching a condition where replacements and betterments can be made on a more permanent basis is evidenced by the increasing use of concrete in irrigation structures."

Methods of placing and cost of concrete lining in laterals on Orland Project, A. N. Burch (*Reclam. Rec.* [*U. S.*], *7 (1916), No. 4, pp. 178, 179, figs. 3; abs. in Engin. and Contract., 45 (1916), No. 15, p. 352*).—Up until February, 1916, there have been lined about 22 miles of laterals on the Orland Project, in sections ranging from a few feet in length and requiring less than a cubic yard of concrete to a maximum section of 8,800 ft. The cross sections of the laterals lined have ranged from a bottom width of 2 ft. and vertical depth of 1 ft. to a bottom width of 8 ft. and vertical depth of 4.5 ft. Laterals originally designed for lining were built with 1:1 bank slopes; other laterals with 1.5:1 and 2:1 slopes. "The aggregates used are run of bank material obtained from creeks in the vicinity of Orland. The proportions of mix are approximately 1:3:5. . . . There is little difference in the cost of lining whether the material be hand or machine mixed, although the machine turns out a better and more uniform grade of concrete."

The total cost per square yard of this work has been 34.3 cts.

Irrigation management, F. H. Newell (*New York and London: D. Appleton & Co., 1916, pp. XIII+306, pls. 8*).—This is a summary of information on methods of operation, maintenance, and betterment of irrigation works. It contains chapters entitled the problems; the physical conditions; the human element; the legal side; operation organization; methods of operation; records and schedules; water economy; maintenance; expenditures, recording, and classifying; receipts and values; the irrigator and his associations; methods of applying water; the products; and conclusions.

The cost of tile drainage on the Trumbull County experiment farm, H. L. Andrew (*Mo. Bul. Ohio Sta., 1 (1916), No. 5, pp. 136–140, figs. 2*).—The costs of tile draining 110 acres of land, which included a total of 7,959 rods of ditch, averaging 30 in. in depth, and 123,541 tile in 3, 3½, 4, 5, 6, and 7 in. sizes laid from 33 to 40 ft. apart, are summarized. The cost per acre averaged 8 cts.

for staking, $21.71 for machine work in cutting trenches, $17.04 for tile, $4.15 for hauling tile, $2.09 for laying tile, and $1.58 for filling ditches, a total of $46.65.

Rational method of selecting types evolved for a comprehensive county road system, W. W. Marr (*Engin. Rec., 73 (1916), No. 17, pp. 536–538, figs. 4*).—It is stated that traffic census, population, and property valuation are the bases used in equalizing the cost for users when designing a county road system in Illinois. Methods of using these factors in the economic selection of road types are described.

Recent developments in the building of concrete roads, W. D. Uhler (*Municipal Jour., 40 (1916), No. 14, pp. 481–483, figs. 3*).—The conclusions drawn from the construction of a 12-mile model concrete road are given.

It was found that the greatest strength commensurate with economy in cost of mixing was obtained from a mix of 1½ minutes duration.

"Another feature is the great variation in strength of 6-in. cubes of the regular mix, made up daily during the progress of the work and set aside for testing at periods of 7, 14, and 28 days, and 6 months. The 7-day compression test runs from 1,065 to 3,633; the 14-day test, from 1,572 to 4,212; and the 28-day test, from 2,362 to 5,361."

It is concluded that ¼-in. joints filled with bitumen with edges rounded and protected with bitumen are more satisfactory and economical than steel protected joints. It is further concluded that better results at the same cost may be secured with a 5-in. side and 7-in. center thickness, using light metal fabric reinforcing, than with plain concrete 6 in. thick at the side and 8 in. in the center. It is stated in conclusion "that the essential features for a good concrete pavement are a hard, dense surface, true to grade and cross section, free from waves, depressions, and irregularities, and one which will insure uniform wear."

Various aggregates in test concrete road, W. H. Connell (*Engin. Rec., 73 (1916), No. 17, pp. 554, 555, figs. 4*).—A description of the construction of a two-mile test pavement, made to test some of the latest theories and practice in concrete road construction, is given.

A study of cracks in a concrete roadway at Indiana University, U. S. Hanna (*Engin. and Contract., 45 (1916), No. 15, pp. 357, 358, fig. 1*).—This is a brief discussion of the cracks in a two-course reinforced concrete road. It is pointed out that "some [of the cracks] are almost certainly due to insufficient lapping of reinforcement. Others appear to be due to failure to secure a subgrade of uniform density. Lack of proper drainage may also have had a part in it."

Concrete road construction in Oakland County, Michigan, M. De Glopper (*Municipal Engin., 50 (1916), No. 4, pp. 140–145, figs. 6*).—This is an article dealing with the practical details of methods of construction employed on this work.

Second biennial report of the Department of Public Roads made to the governor and general assembly of Kentucky, R. C. Terrell (*Bien. Rpt. Dept. Pub. Roads Ky., 2 (1913–1915), pp. 162, pls. 32*).—This report covers the work and expenditures, by counties, of the department in Kentucky from November 1, 1913, to November 1, 1915.

Annual report of the Baltimore County [Maryland] roads engineer, W. G. Sucro (*Ann. Rpt. Roads Engin. Baltimore Co. [Md.] 1915, pp. 90, pl. 1, figs. 17*).—This reports the activities and expenditures of the county roads engineer's office on roads and bridges in the different districts of the county during 1915.

Country roads board [Victoria], first annual report (*Ann. Rpt. Country Roads Bd. Victoria, 1 (1914), pp. 94, pls. 7, figs. 88*).—This report deals mainly with preliminary work connected with the investigation of highways, the condition of the roads in different districts, and methods of dealing with roads by the Government and municipalities of Victoria.

Recent road legislation of Iowa, edited by H. E. SAMPSON and T. H. MACDONALD (*Iowa State Highway Com. Serv. Bul., 3 (1915), No. 9, Sup., pp. 104*).—The text of the law is given.

The law of Ohio governing roads and bridges, W. M. ROCKEL (*Cincinnati, Ohio: The W. H. Anderson Co., 1916, pp. XL+646*).—This gives the text of the Ohio laws governing roads and bridges, including the establishment, construction, improvement, and repair of roads and bridges by state, county, and township officials; and the text of the law as to the adjoining landowners and the traveling public.

Experiments with dynamite, F. WATTS (*Imp. Dept. Agr. West Indies, Rpt. Bot. Sta. [etc.] Antigua, 1914–15, pp. 29, 30*).—Experiments on heavy calcareous loam soil in growing plant and ratoon canes using 2-oz. dynamite cartridges inserted 2.5 ft. deep gave results which are not considered remunerative. In similar experiments on heavy clay soil an increase was obtained in the ratoon crop and a decrease in the plant cane crop.

Gravel as an aggregate for concrete, H. H. SCHOFIELD and C. C. BROWN (*Municipal Engin., 50 (1916), No. 4, pp. 135–137*).—A study of existing data on gravel and sand for concrete is reported. The results are taken to indicate "that there is need of an investigation for the purpose of fixing a rational specification for gravel for concrete. Such a specification should take into account, among other things, the durability of the particles, the grading, the cleanness, and the proportions for different classes of natural gravels and for different classes of work."

Amount of water to use in concrete, E. MCCULLOUGH (*Cement Era, 14 (1916), No. 5, pp. 50, 51*).—The author reviews his practical experience and reports the results of experiments in which it was found that slightly less than 6 lbs. of water per cubic foot of loose materials produced the ideal mixture for concrete roads. It was also found that a full minute of mixing was necessary to get the water distributed through the mass.

Making mortar impervious and anthracenic oil, R. FERET (*Ann. Ponts et Chaussées, 9. ser., 28 (1915), pt. 1, No. 20, pp. 51–71*).—Experiments with three Portland cements to determine the influence on the strength and properties of the mortar of the addition of anthracenic oil for waterproofing purposes are repored.

In the first series of experiments a mortar composed of 1 part cement to 3 parts of coarse sand was used, to which the oil was added in amounts of 5 and 10 per cent of the weight of the cement used. It was found that the use of the oil slightly increased the total volume of the mortar without markedly modifying the density. Mortars containing oil were less porous after a week than those without oil. The tensile and compressive strengths of the mortars were considerably decreased, especially when 10 per cent oil was used.

Tests of the permeability under heads of water varying from 20 to 70 meters showed that oil-treated mortar stored 14 days in moist air and 14 days in water was considerably more impervious than the mortar without oil. Mortar stored 14 days in moist air and 38 days in water and containing 5 per cent of oil was more pervious than the mix without oil at heads between 20 and 40 meters, but with higher heads the oil mixtures were less pervious. These results are taken to indicate that it is inadvisable to use more than 5 per cent oil.

In the second series of experiments, the mortar mixtures used were 600 kg. of cement per cubic meter of fine sand, 500 kg. of cement per cubic meter of coarse sand, and 400 kg. of cement per cubic meter of gravelly sand containing a large amount of grains of a diameter varying between 5 and 20 mm. The proportions of oil used were 3 and 5 per cent of the weight of the cement. It was found that, with the exception of some of the tests on the fine sand mortar, the mortar containing 3 per cent of oil was less pervious than that without oil. When 5 per cent of oil was used the results in this respect were very variable. At the higher heads these mortars were more pervious than the mortar containing 3 per cent of oil. The addition of 3 per cent of oil did not appreciably decrease the strength of the mortar or its power of adhering to iron. The results as a whole are taken to indicate that 3 per cent of oil may be used to advantage in cement mortar.

See also a previous note by the author (E. S. R., 30, p. 889).

The influence of compression in internal-combustion engines, R. E. Mathot (*Power, 43 (1916), No. 15, pp. 512–514, figs. 2*).—It is shown that within certain limits neither the amount of compression nor the heat value of the fuel affects the output of the engine, although the former does affect the economy.

Tables of data from actual practice covering over 600 tests on about 40 different makes of internal-combustion engines are also included, showing the proper mixtures and compressions to be used with different fuels in order to attain the best results.

Some engine plow troubles and their remedies, C. O. Reed (*Amer. Thresherman, 18 (1916), Nos. 11, pp. 68, 69; 12, pp. 14, 15, figs. 3*).—Information regarding the prevention of excessive draft, failure to scour, uneven furrow crowns, and failure to penetrate is given, together with brief instructions regarding laying out fields and buying and starting a new plow.

Recent inventions in machines for tilling the soil, M. Castelli (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 11, pp. 1424–1437*).—This article describes some of the more recent improvements in tillage machinery, dealing mainly with mechanically propelled types.

Mechanical cultivating apparatus, M. Ringelmann (*Rev. Vit., 43 (1915), Nos. 1112, pp. 305–310; 1115, pp. 361–366; 1116, pp. 377–383*).—A number of types of mechanically operated tillage machines for use in truck and vineyard work are described.

Culture machinery, G. Coupan (*Encyclopédie Agricole. Machines de Culture. Paris: J. B. Baillière & Sons, 1915, 2. ed., pp. XIV+480, figs. 376*).—This is a number of the Encyclopédie Agricole and deals in general with the machines and mechanical methods employed in the preparation of the soil, the spreading of fertilizers and seeds, and the maintenance of culture. A large amount of mechanical, mathematical, diagrammatical, and practical data related to the construction and operation of the different machines is given.

Experiments on the draft of a model plow under different working conditions and their practical application, G. Kühne (*Untersuchungen über den Zugwiderstand eines Pflugwerkzeugmodelles bei verschiedenen Arbeitsbedingungen und ihre Anwendung auf praktische Verhältnisse. Inaug. Diss., Univ. Giessen, 1914, pp. 49, figs. 24*).—The factors affecting the draft of a moldboard plow are discussed, experimental apparatus is described, and laboratory experiments with a model moldboard plow are reported to determine the influence on draft of different physical factors under different working conditions in soils artificially prepared.

It was found in sand and loam soil that by steadily increasing the speed of plowing under the same working conditions the plowing draft steadily in-

creased to a certain limit and then decreased with increasing speed. By steadily increasing the working depth in sand and loam soil under the same working conditions the draft increased in approximate proportion to the depth until an optimum draft with reference to cross section was reached, and thereafter increased faster than the depth. Steadily increasing the width of plowing produced results in draft similar to those produced by varying the depth of plowing only in sand soil.

The soils were artificially compressed. The plowing draft increased with increasing compactness of a uniformly damp sand soil at a rate greater than a proportional rate. The draft also increased with the increasing dampness of a sand soil up to a certain limit and thereafter decreased. In a soil dampened irregularly the draft increased with decreasing dampness. The practical application of these methods and results to field conditions is also discussed.

Comparison of team and tractor for hauling gravel, O. L. KIPP (*Municipal Engin., 50* (*1916*), *No. 4, pp. 138, 139*).—Data are presented from the gravel checker's records on five team-hauling jobs totaling 22 miles of road gravelled and 1 tractor-hauling job covering 3.6 miles of road gravelled, the gravel being placed at the rate of 15 cu. yds. per 100-ft. station on each job. A 36-60 horse-power caterpillar gas tractor and a train of 3.5-yd. reversible spreader wagons with a 50-yd. storage bin and a belt conveyor loader were used.

"It would appear that the cost of hauling by tractor was considerably less than by teams. The advantage in favor of the tractor would have been greater had there been more power available. A 40-80 tractor would have made a much better showing. Another factor cutting down the capacity of the train was the inability of the loading equipment to supply gravel fast enough. . . . It would appear that efficiency in team hauling and consequent low cost is largely dependent upon, and might easily be secured by, obtaining the maximum efficiency in loading." Features in favor of tractor hauling were that, first, by applying the gravel in two courses with a tractor the gravel is rolled without additional cost and the road is ready for travel as soon as the gravel is applied, instead of a month or more later, as with teams; and second, by loading into a bin, thence to wagons, and thence to the road, an efficient mix of the materials is obtained.

Knots and splices, I. D. CHARLTON (*Wash. Agr., 9* (*1916*), *No. 7, pp. 191–195, figs. 4*).—A few of the more simple and common knots used in farm work with rope are described and illustrated.

Barns for Wisconsin dairy farms, F. M. WHITE and C. I. GRIFFITH (*Wisconsin Sta. Bul. 266* (*1916*), *pp. 32, figs. 25*).—This bulletin discusses the general requirements of and the more important factors to be considered in the construction of barns for dairy farms to meet Wisconsin conditions and describes three general-purpose barns, one single story dairy barn, and a pioneer barn. Rectangular barns are considered more satisfactory than round ones, and gambrel roofs are preferred to gable roofs.

Construction of fresh air brooders, H. E. UPTON (*Brit. Columbia Dept. Agr., Live-Stock Branch, Circ. 3, 2. ed.* (*1913*), *pp. 6, figs. 6*).—This structure is briefly described and illustrated.

Winter storage of potatoes, E. SCHAFFNIT (*Ztschr. Landw. Kammer Braunschweig, 84* (*1915*), *No. 28, pp. 245–249, figs. 2*).—In outlining the conditions for proper winter storage of potatoes, it is pointed out that the potatoes must be absolutely protected from frost, and must, at the same time, be kept dry and not too warm, as both heat and dampness are favorable to the rotting of potatoes.

Water problem simplified, W. A. ETHERTON (*Farm Engin., 3 (1916), No. 11, pp. 249, 250, figs. 4*).—A simple water supply system consisting essentially of a pump, hot-water tank, and sink, and employing a three-way cock for supplying hot and cold water, is described and illustrated.

RURAL ECONOMICS.

What is agricultural economics? E. G. NOURSE (*Jour. Polit. Econ., 24 (1916), No. 4, pp. 363–381*).—The author points out that agricultural economics is an application of general economics to the practical business of agriculture rather than an independent study of doctrines built up out of a specialized body of data.

"An examination of text-books and college announcements seems to indicate that at present most courses with a rather detailed study of production (now often including marketing) and, except for the many who stop with that, leap over to a fragmentary discussion of distribution as touching the farmer's profits. But this is no adequate preparation for meeting the more intricate problems facing modern agriculture. The student, besides examining the economic factors in technical productive efficiency, needs to understand the laws of value and the process by which physical units of product are fitted to psychic units of want through the agency of an exchange mechanism; he needs to consider not only how this aggregate lump of values is broken up into private incomes, but how the use of this wealth in private hands reacts upon the further operation of the system. Even when for practical reasons the course in agricultural economics must be much compacted, it should be reduced to a stout framework of fundamental principles instead of bloating into a flabby mass of descriptive generalities. . . .

"Our purpose in elaborating an economics of agriculture is to train the agriculturist in the business principles which govern the commercial success or failure of his enterprise, but not less to enable him and likewise those others who are not engaged in agriculture to perceive the economic results which will flow from one sort of agrictultural organization or another, from one sort or another of consumption of our resources of land, labor, and capital."

Economic cycles: Their law and cause, H. L. MOORE (*New York: The Macmillan Co., 1914, pp. VIII+149, figs. 27*).—The author attempts to trace the influence of the weather upon crop production and the influence of variations in crop production upon prices. He claims that the fundamental, persistent cause of the cycles in the yields of the crops is the cyclical movement in the weather conditions represented by the rhythmically changing amount of rainfall. These cycles are of 33 and of 8-year periods.

The falling yield in crops leads to a diminution of the volume of trade, a decline in the demand for producers' goods, a fall in the prices of producers' goods, a decrease in employment, and a fall of the demand curves for crops, with the final result of a fall in general prices. Similarly, a rising yield in the crops leads to an increase in the volume of trade, an increase in the demand for producers' goods, an increase of employment, and a rise in the demand curves for crops, with the final result of a rise in general prices.

He states that the cycles in the yield per acre of crops are followed at an interval of two years by cycles in the activities of industry and in the volume of trade, and at an interval of about four years by cycles in prices.

Wages and rural migration, A. BECKERICH (*Ann. Sci. Agron., 4. ser., 4 (1915), July–Sept., pp. 85–214*).—The author discusses the movement of wages of the different classes of agricultural workers in various agricultural regions of France, the movement of prices of agricultural products and the number of

agricultural workers, and the influence of agricultural machinery and the introduction of foreign laborers. A brief bibliography is appended.

Results of a survey of state marketing activities throughout the United States (*U. S. Dept. Agr., Office Markets and Rural Organ. Doc. 3* (*1916*), *pp. 7*).—This is a summary by States, based on the replies to a questionnaire sent to representative officials in each State to determine what States have established official marketing departments, the agency charged with this work, and the nature and scope of the work being done, both by such specially created departments and by the extension divisions of the State agricultural colleges.

Associations for marketing meat in Germany, H. Horst (*Landw. Jahrb., 48* (*1915*), *No. 1, pp. 1–136, fig. 1*).—This article points out the causes of the formation of associations to slaughter live stock and market their products, and gives the aims and organization of the associations and their development in different regions of Germany.

The Grange in Canada, H. Michell (*Bul. Depts. Hist. and Polit. and Econ. Sci., Queen's Univ. Ontario, No. 13* (*1914*), *pp. 20*).—This report contains a brief historical sketch of the Grange movement in Canada.

Ohio agricultural statistics, 1914–15 (*Ohio Agr. Statis., 1914–15, pp. 78*).—This report gives statistical data gathered by the township assessors concerning the acreage and production of the principal agricultural crops, the number of live stock, quantity of live-stock products, and other facts relative to the agriculture of Ohio.

[Trade and commerce in agricultural products in Chicago], 1915 (*Ann. Rpt. Bd. Trade Chicago, 58* (*1915*), *pp. XXXIX+142*).—This volume contains the reports of the different committees of the Chicago Board of Trade and the daily and monthly movement during 1915 of the principal agricultural products by routes, prices, and freight rates, together with the acreage, production, and value of live stock and crops in the United States and in the different countries of the world. An appendix is given showing the rules, by-laws, and regulations of the board.

Prices and supplies of grain, live stock, and other agricultural produce in Scotland (*Agr. Statis. Scotland, 3* (*1914*), *pt. 3, pp. 183–237, figs. 2*).—This report continues data previously noted (E. S. R., 33, p. 492).

Agricultural and live stock statistics of Finland (*Statis. Arsbok Finland, n. ser., 11* (*1913*), *pp. 109–127; 12* (*1914*), *pp. 116–143*).—This continues data previously noted (E. S. R., 30, p. 692).

Price statistics (*Ungar. Statis. Mitt., n. ser., 44* (*1913*), *pp. IX+62*+427*).—This volume contains statistical data showing prices and index numbers for agricultural and other products in Hungary for a long series of years.

Supply of foodstuffs and prices in foreign countries during the war (*Ztschr. Agrarpolitik, 14* (*1916*), *No. 1, pp.* [*1–8*]).—This article gives the quantity of the principal agricultural crops available in the countries at war with Germany, together with prices. Similar data for previous years are also given for comparative purposes.

World's production of foodstuffs and raw materials, and the provisions from German Colonies in the past and possibilities of the future, A. Schulte im Hofe (*Tropenpflanzer, Beihefte, 16* (*1916*), *No. 1–2, pp. V+177*).—In this report are discussed the world's production and trade in various agricultural and live-stock products and fertilizing materials, and the influence of the colonial possessions of different nations in contributing foodstuffs to the mother country. The discussion is accompanied by a large number of statistical tables.

Statistics of commerce of the French Colonies, 1913 (*Statis. Com. Colon. Franç., 1913, I, pp. 1197; II, pp. 1069*).—In this report are given statistics

concerning the trade in agricultural and other products, showing sources and destination.

Review of the trade of India, 1914–15 (*Dept. Statis. India, Rev. Trade India, 1914–15, pp. II+139+VII, pls. 7, figs. 5*).—This report gives a review of the effects of the war on the foreign and inland trade of India, as well as statistical data showing the imports and exports by articles, wholesale prices, wages paid in selected industries, customs revenue, number and tonnage of vessels engaged in foreign and coastwise trade, and freight rates. Comparative data are given for earlier years.

AGRICULTURAL EDUCATION.

Graduate work in horticulture, M. J. Dorsey (*Proc. Soc. Hort. Sci., 11 (1914), pp. 70–77*).—The relation between the present status of horticulture and graduate work or advanced training which will so intimately influence future development is discussed, including a consideration of the preliminary training for graduate work, the laboratory method, the relation between graduate work and station research, and factors influencing graduate work. The author concludes that "emphasis must be placed again and again upon fundamental training, as well as upon a knowledge of the material. Science, truth, and proof are just the same in the applied fields as in the pure sciences, and this should be made clear to every graduate student. When full recognition is given to this, research will mean just as much scientifically in the applied fields as in the pure sciences, and the weakness of one-sided practical training will become more and more apparent."

Required trips for horticultural students, F. N. Fagan (*Proc. Soc. Hort. Sci., 11 (1914), pp. 37–40*).—The author gives an account of a horticultural inspection trip taken with 24 students in the summer of 1914, visiting fruit and seed farms, vegetable forcing and trucking, flower growing, and spray machinery places, nurseries, parks, canning and evaporation houses, greenhouse firms, basket and barrel factories, and cold storages, in western New York and northern and northwestern Pennsylvania. This was accomplished in about 28 or 30 working days, at an average expense of from $80 to $130 a man.

These trips have been required of junior horticultural students at the Pennsylvania College since the summer of 1913. To receive the six credits allowed for this summer work the students must submit during the first half of their senior year a typewritten report of the trip. Prior to 1913 junior horticultural students were required to spend at least six weeks working on commercial horticultural farms. It was found, however, in many cases that the students often were not engaged in true horticultural work on these farms and were given one job practically the entire summer. Hence the inspection trips were substituted for this work.

One phase of agricultural education in Indiana: Supervision of home project work, Z. M. Smith (*Dept. Pub. Instr. [Ind.], Ed. Pubs., Bul. 22 (1916), pp. 28, figs. 26*).—This bulletin reports on (1) the supervision by 21 teachers of home-project work in Indiana in 1915, comprising the work of 7 vocational agricultural teachers, employed by as many townships as supervisors of summer projects of 136 men and boys, and the work of 14 teachers employed jointly by the local authorities and the Purdue University extension department in supervising the projects of 420 boys and girls; (2) home problems reached; (3) the supervision of club project work by county agricultural agents who organized 112 clubs with a total membership of 3,697 boys and girls; (4) the short-course week at Purdue University in January, 1916, which

was the culmination of the 1915 home-project work; and (5) records of a few club members.

The Indiana State Board of Education has decided that school authorities be authorized to give credit for summer home-project work (club work) on condition that a competent teacher be employed to give close supervision over the work, that the quality or grade of work done and the time actually spent on the project by the pupil be considered on the same basis as regular school work, and that each pupil keep detailed records of time and other items of cost and income and submit to the school authorities a full and complete report of his work, subject to the inspection of the state department.

Home education, Ellen C. Lombard (*Rpt. Comr. Ed. [U. S.], 1915, I, pp. 361–369*).—A review is given of the problems of the field of home education in this country and its insular territories, and of the work of the different Government agencies, the National Congress of Mothers, parent-teacher associations, and the General Federation of Women's Clubs for the promotion of home education outside of the school.

The principles of plant culture, E. S. Goff (*New York: The Macmillan Co., 1916, 8. ed., pp. XXIII+295, figs. 177*).—This text, which is intended for beginners in agriculture and horticulture and especially for students who have had little or no previous instruction in botany, was first published by the author in 1897 (E. S. R., 8, p. 793) and has since undergone several revisions, the present revision being by J. G. Moore and L. R. Jones. It is a systematic study of plant culture which grew out of the author's experience in the lecture room and laboratory while giving instruction to students in the short course in agriculture in the University of Wisconsin. A syllabus of laboratory work is appended and the preface includes a biographical sketch of the author, who died in 1902.

Courses in systematic vegetable gardening, P. Work (*Proc. Soc. Hort. Sci., 11 (1914), pp. 33–37*).—The vegetable gardening courses offered at Cornell University are described.

Report of the committee on floricultural courses, A. C. Beal (*Proc. Soc. Hort. Sci., 11 (1914), pp. 40–43*).—The author gives historical data on floricultural teaching, the first floricultural courses, extending through four years, having been offered in the School of Horticulture of the Illinois Industrial University in 1875–76.

MISCELLANEOUS.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916), No. 5, pp. 129–160, figs. 8*).—This contains several articles abstracted elsewhere in this issue; Wool Studies, by J. W. Hammond, an abridgment of Bulletin 294 (see p. 477); Heavy Silage *v.* Heavy Grain, Feeding for Dairy Cows, by C. C. Hayden, an abridgment of Bulletin 155 (E. S. R., 16, p. 811); Controlling the Grape-berry Worm, by W. H. Goodwin, an abridgment of Bulletin 293 (E. S. R., 35, p. 358); and the following special articles: Fruit-bud Formation on Apple Trees, by A. D. Selby, and Shall We Fertilize Corn in the Hill, by C. E. Thorne.

Monthly Bulletin of the Western Washington Substation (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 3, pp. 16, figs. 3*).—This number contains brief articles on the following subjects: Notes on Bee Management, by J. W. Ware; Rose Pests and Their Control, by J. L. Stahl; Summer Cultivation, by E. B. Stookey; Milk-fed Chickens, by G. R. Shoup; A Penny Saved is a Penny Earned, by Mrs. G. R. Shoup; and Experiment Station Dairy Barn, a description of the dairy stable and shed at the substation.

NOTES.

Iowa College.—According to a note in *Minnesota Farm Review*, Kenneth McGregor, instructor in animal husbandry, has been appointed in charge of the department of animal husbandry in the University of Alberta.

Maryland College and Station.—Recent appointments include C. J. Pierson as assistant in the department of entomology and zoology in the college, O. I. Snapp as fellow in insect investigations in the college and station, and Dr. Philip Garman as assistant entomologist in the station.

Michigan College.—*Science* states that G. R. Johnstone has resigned as instructor in botany to take up graduate work and has been succeeded by H. E. Young of the Missouri Botanical Garden.

Virginia College and Station.—During the summer, field meetings have been held at several of the county substations, affording opportunities to many farmers to observe the results of the fertilizer experiments, crop rotations, cultural treatments, variety studies, etc. The substations are regarded as rendering valuable service to the farmers in the solution of local problems.

J. Thompson Brown, J. B. Watkins, and J. A. Turner have been reappointed to the board of trustees. W. B. Ellett has been assigned a teaching course in agricultural chemistry in the college in addition to his duties as station chemist. H. E. Thomas, a 1916 graduate of the college, has been appointed assistant plant pathologist, while K. E. Quantz has been transferred from the department of plant pathology to that of horticulture. J. T. Grissom resigned August 1 as assistant chemist to engage in commercial work. A. A. Ingham, instructor in horticulture, has also been appointed assistant horticulturist in the station.

Virginia Truck Station.—H. H. Zimmerley has resigned as assistant horticulturist to accept a position as demonstration agent for Kent County, Delaware.

West Virginia University and Station.—Among the changes effective July 1 was the resignation of I. S. Cook as professor of agronomy and agronomist. Professor Cook has been appointed county agricultural agent of Ohio County, with headquarters at Wheeling, vice Horace Atwood resigned to become poultryman in the station, and has been succeeded by Forest W. Stemple. O. M. Johnson resigned as professor of farm management to become state agent for the Ohio State University. Charles E. Stockdale was appointed editor of the station and extension department. E. A. Tuckwiller resigned as assistant animal husbandman in charge of beef cattle at Lewisburg to become extension specialist in animal husbandry at the station, and was succeeded by R. H. Tuckwiller. R. R. Jeffries resigned as extension specialist in horticulture to become county agent at Cañon Falls, Colo., and was succeeded by W. R. Legge. George W. Burke was appointed assistant chemist in the station, Robert B. Dustman extension specialist in agronomy, and S. A. Cody specialist in poultry husbandry extension work. David H. Kauffman resigned from the extension work in soils.

F. E. Bear has resigned as soils chemist and head of the soils department, effective September 15, to become professor of soils at the Ohio State University.

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U. S. DEPARTMENT OF AGRICULTURE

STATES RELATIONS SERVICE

A. C. TRUE, DIRECTOR

Vol. 35 ABSTRACT NUMBER No. 6

EXPERIMENT STATION RECORD

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1916

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U. S. Department of Agriculture—Contd.

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EXPERIMENT STATION RECORD.

VOL. 35. ABSTRACT NUMBER. No. 6.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Organic agricultural chemistry, J. S. CHAMBERLAIN (*New York: The Macmillan Co., 1916, pp. XVII+319*).—This volume is divided into three sections: (1) Systematic, which includes the study of the composition, constitution, character, and relationship of the more important organic compounds occurring in plants and animals; (2) physiological, which embraces a study of the chemical reactions involved in the fundamental processes of living organisms, in the utilization of food by animals, and in photosynthesis in plants; and (3) crops, foods, and feeding, which includes the study of the distribution of food constituents in agricultural crops and the principles of animal foods and feeding. The presentation of the subject matter is general and of such a nature as to follow a course in general chemistry.

An introduction to the physics and chemistry of colloids, E. HATSCHEK (*Philadelphia: P. Blakiston's Son & Co., 1916, 2. ed., pp. IX+107, figs. 17*).—This is the second edition of a volume, the subject matter of which has been essentially noted (E. S. R., 29, p. 608). The only substantial addition to the text of the first edition is an appendix on experimental technique.

Studies on plant colloids, II–VI, M. SAMEC ET AL. (*Kolloidchem. Beihefte, 4 (1912), No. 3–5, pp. 132–174, figs. 13; 5 (1913), No. 5, pp. 141–210, figs. 31; 6 (1914), No. 1, pp. 23–54, figs. 12; 7 (1915), No. 6–12, pp. 137–171, figs. 9; 8 (1916), No. 1–2, pp. 33–62, figs. 7*).—Five papers are presented.

II. *The stability of starch solutions,* M. Samec.—Continuing the study previously noted (E. S. R., 30, p. 111) it is shown that the viscosity of a starch solution decreases appreciably with time. The final viscosity of a 1 per cent starch solution lies within the limits of the viscosity of molecular disperse systems. This decrease in viscosity is greater in dilute than in concentrated solutions. Hydrochloric acid retards the initial viscosity of starch solutions, but later prevents a decrease (stabilizer). Alkalis in the lowest concentration increase the viscosity of starch solutions and in higher concentrations coagulate them. Of the neutral salts ammonium sulphate and ammonium thiocyanate also decrease the internal molecular friction of the starch particles. The sensitiveness to the action of electrolytes decreases with increasing age of the starch solution. With a decrease of internal friction the electrical conductivity increases.

The removal of the ash, the action of electrolytes, and also the change in the behavior of starch in the electrical field can be explained as due to the presence of an ionized starch-phosphoric-acid complex.

III. *Changes in starch by removal of the ash and solution,* M. Samec and F. von Hoefft.—The three processes of removing the ash, solution, and aging produce the same changes in the properties of starch, viz, a decrease in the internal friction and in the influence of acids and bases on the latter. The rapidity of the changes is proportional to the temperature. Simultaneously with a decrease in viscosity there is an increase in the electrical conductivity and a decrease in the amount of starch precipitable by alcohol. The osmotic pressure is only slightly lowered, while the optical rotation is slightly increased. The titratable acid is also increased. At ordinary temperatures only small amounts of electrolyte can be extracted from the starch by water, but as the starch grains swell the amount extracted increases. It is indicated that the above observations and many others made by earlier investigators can be explained by the presence of an amylophosphoric acid.

IV. *The displacement of the phosphoric acid content by a change of condition of the starch and by diastatic cleavage,* M. Samec.—From starch grains which had been treated with potassium hydroxid a fraction containing phosphorus and a phosphorus-free fraction were isolated. By the diastatic cleavage phosphorus-containing dextrins which possessed all the properties of electro-negative colloids were obtained. On boiling with water these dextrins were destroyed and phosphoric acid was set free.

V. *On soluble starch,* M. Samec and S. Jencic.—Starch, in being converted to the soluble form, was essentially changed in structure. In most instances a contraction of the starch particles was apparent, while in exceptional cases there was no alteration. Most soluble starches contain phosphorus, but not those prepared according to the procedure of Malfitano and Moschkoff[a] and those prepared by heating in glycerin. On account of the variations in the physicochemical characteristics of the so-called soluble starch the term is considered scientifically inadequate. The experimental procedures used in the investigation are described in detail.

VI. *On alkali starch,* M. Samec.—By the action of alkalis on starch a number of different modifications could be demonstrated. The formation of two of these was attributed to the action of the alkali with the phosphoric acid of the starch (amylophosphate). By the continued action of the alkalis they are also bound at other points in the starch molecule, forming amylates. These substances finally cause a cleavage of the starch complex.

Crystalline β-methyl fructosid and its tetracetate, C. S. Hudson and D. H. Brauns (*Jour. Amer. Chem. Soc., 38 (1916), No. 6, pp. 1216–1223*).

A fourth crystalline pentacetate of galactose and some related compounds, C. S. Hudson and J. M. Johnson (*Jour. Amer. Chem. Soc., 38 (1916), No. 6, pp. 1223–1228*).

The determination of phosphoric acid by the uranylacetate method, D. Crispo and R. W. Tuinzing (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 17 (1915), pp. 142–156; Landw. Vers. Stat., 88 (1916), No. 1–2, pp. 131–141*).—A modified procedure for the uranyl-acetate method for the determination of phosphoric acid is described in detail. The phosphoric acid is first precipitated as ammonium-magnesium phosphate, the precipitate dissolved in acetic acid, and the solution then titrated with the standard uranium solution. The method is applicable to the determination of the various forms of phosphoric acid present in fertilizers without the usual inherent difficulties. Experimental data submitted, comparing the proposed procedure with the official methods of Lorenz and Pemberton, indi-

[a] Compt. Rend. Acad. Sci. [Paris], 150 (1910), No. 11, pp. 710, 711; 151 (1910), No. 19, pp. 817–819.

cate its accuracy. The uranyl oxid can be easily recovered from the phosphate precipitate.

On the solubility of phosphoric acid in Thomas slag by extraction with water containing carbon dioxid, J. G. MASCHHAUPT (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 17 (1915), pp. 97–141, figs. 5*).—Analytical data indicating the amount of phosphoric acid of Thomas slag soluble in water containing carbon dioxid, with various amounts of calcium oxid and silicate present in the slag, are submitted in detail. The data are discussed and the value of such a procedure for determining the available phosphoric acid in slag fertilizers is emphasized.

Experiments on the extraction of potash from wyomingite, R. C. WELLS (*U. S. Geol. Survey, Prof. Paper No. 98–D (1916), pp. 37–40*).—This paper records experimental data on the chemical and mineral composition of wyomingite (a lava occurring extensively in the Leucite Hills in Sweetwater County, Wyo.), its behavior in water, and the effect of heating with gypsum, sulphuric acid, potassium bisulphate, alunite, calcium carbonate, calcium chlorid, magnesium chlorid, a bittern, and ammonium sulphate. The percentage of the total potash extracted by heating with the various materials ranged from 16.2 to 57, the largest amount being obtained by heating with alunite.

It is indicated that while the experiments described can not all be considered as commercial possibilities they may be suggestive to other investigators and save the repetition of considerable preliminary investigation.

A new apparatus for the determination of soil carbonates and new methods for the determination of soil acidity, E. TRUOG (*Jour. Indus. and Engin. Chem., 8 (1916), No. 4, pp. 341–345, figs. 2*).—A new form of apparatus, using the absorption tower previously noted (E. S. R., 34, p. 504), and its manipulation are described in detail.

Experimental evidence indicates that there exist in the soil two kinds of acidity which are designated as active and latent. Methods for their separate determination are proposed. It is further indicated that "soil acidity is due to true acids and not selective ion adsorption by colloids; the avidity of the active acids in different soils varies greatly, which is of prime importance." See also a previous note by the author (E. S. R., 34, p. 419).

The analysis of Hawaiian soils, W. T. MCGEORGE (*Hawaii Sta. Rpt. 1915, pp. 33–36*).—Slight modifications in the official methods to meet certain peculiarities encountered in Hawaiian soils, notably the high content of iron, aluminum, titanium, and manganese, are presented, together with results secured with four soils as to the influence of the time of digestion upon the solvent properties of hydrochloric acid.

On the determination of small quantities of hydrocyanic acid, M. O. JOHNSON (*Jour. Amer. Chem. Soc., 38 (1916), No. 6, pp. 1230–1235, fig. 1*).—The method described by Francis and Connell (E. S. R., 30, p. 709) has been shown to require certain modifications, which the author has embodied in a convenient and accurate procedure for the determination of small quantities of hydrocyanic acid. The potassium thiocyanate is extracted with acetone and then determined colorimetrically by the production of the ferric thiocyanate. Any organic coloring matter which may interfere with the color of the ferric thiocyanate is removed from the solution by extraction with ethyl acetate.

The procedure was evolved in connection with some chemical work on cassava at the Hawaii Experiment Station.

The microscopy of vegetable foods, A. L. WINTON, J. MOELLER, and KATE B. WINTON (*New York: John Wiley & Sons, Inc., 1916, 2. ed., rev. and enl., pp. XIV+701, figs. 635*).—This volume is the second edition of the work previously noted (E. S. R., 17, p. 1096) and deals with the microscopy of vegetable foods,

with special reference to the detection of adulterants and the diagnosis of mixtures. The first part is devoted to general considerations, methods, apparatus, reagents, etc., while the succeeding parts are devoted to the microscopy of the individual substances. The subjects considered are cereal products, together with the commonly associated impurities; oil seeds; legumes; nuts; fruit and fruit products; vegetables, such as tubers, roots, fungi, etc.; alkaloidal products and their substitutes; spices and condiments; and commercial starches. The text is fully illustrated and a general bibliography and glossary are included.

Quantitative sublimation and its application in food analysis, MADAME GOBERT (*Ann. Falsif., 9 (1916), No. 88–89, pp. 96–98, fig. 1*).—This article describes a small sublimator which is easily constructed and yields quantitative results. A method for the determination of caffein in coffee and in tea, using this apparatus, is also described.

Studies on commercial chicory, M. SIROT and G. JOBET (*Ann. Falsif., 9 (1916), No. 88–89, pp. 48–63*).—This article describes commercial chicory products and indicates the regulations adopted by the Congress of Paris in 1909 for the control of the purity of the material. Complete analytical data of a number of genuine samples, together with data of adulterated samples and imitations, are submitted in detail and briefly discussed.

The determination of the constituents of cotton seed and peanuts and their determination in feeding stuffs, J. A. EZENDAM (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat. [Netherlands], No. 17 (1915), pp. 89–96, pl. 1*).—The author describes a microchemical method for the determination of the presence of cotton-seed meal in a mixed feeding stuff and also a procedure for the determination of small amounts of peanut oil cake.

The action of copper solutions on sucrose. Determination of invert sugar in the presence of sucrose, E. SAILLARD (*Compt. Rend. Acad. Sci [Paris], 161 (1915), No. 20, pp. 591–593*).—In determining reducing sugars in the presence of sucrose an error is introduced which yields high results. The increased reduction is dependent on the concentration of the sucrose and of the reducing sugars, on the copper solution, and on the manner of heating. Analytical data submitted demonstrate that an increase in the quantity of invert sugar present decreases the amount of reduction of sucrose. When the reducing sugars correspond very nearly to the amount of copper in solution the reduction is practically negligible. The time of heating and the concentration of the solution also affect the amount of reduction of sucrose. The following procedure for the determination of reducing sugars in beets, sirups, sugars, and molasses is proposed:

A normal solution of the material is cleared with lead subacetate, the excess lead removed with sodium carbonate, and the reducing sugars determined in 50 cc. of the clear filtrate by adding 10 cc. of copper solution and 10 cc. of alkaline solution and heating for 22 minutes on the water bath at from 62 to 64° C. The cuprous oxid is then filtered on an Allihn tube and determined according to the Bertrand procedure. The alkaline solution used in the modified procedure is less concentrated than the one generally recommended.

The determination of sucrose in beet molasses (Clerget-Saillard double neutral polarization method), E. SAILLARD (*Rev. Gén. Chim., 18 (1915), No. 2, pp. 42–46*).—As previously noted (E. S. R., 28, p. 711), the author maintains that the presence of nitrogenous substances (asparagin, aspartic acid, glutamin, glutamic acid, etc.) so influences the plane of rotation as to make the method of Clerget unreliable. A modified procedure which obviates the effect of the nitrogenous substances present by determining the polarization in a neutral solution is described in detail. The effect of various salts on the

sucrose, the invert sugar, and on the nitrogenous substances in the sugar solution was also studied and the results recorded. Analytical data indicate the accuracy of the modified method by the close agreement with results obtained by the usual copper-solution procedure.

A new species of alcohol-forming bacterium isolated from the interior of stalks of sugar cane infested with the cane borer Diatræa saccharalis, W. L. OWEN (*Jour. Bact., 1 (1916), No. 2, pp. 235–246, pl. 1*).—The morphological, cultural, and physiological characteristics of a new species of alcohol-forming bacterium isolated from borer-infested sugar cane, which the author has named *Bacillus saccharalis*, are described in detail. Sucrose, glucose, levulose, mannite, lactose, galactose, raffinose, maltose, and glycerin are all fermented by the organism. From field experiments on the sugar cane it is concluded that "*B. saccharalis* does not induce any marked deterioration of the juice of growing cane, and indeed the apparently negative results which indicated a higher purity in the inoculated canes is well within the range of possible results from the action of the species."

The conservation of potatoes by spontaneous and pure culture inoculation souring, W. VÖLTZ and H. JANTZON (*Landw. Jahrb., 48 (1915), No. 4, pp. 493–534*).—Two methods for conserving the surplus potato crop, later to be used as stock food, are described in detail.

It has been demonstrated that for raw potatoes only water-tight pits (concrete or mortar lined) are practicable. Under average favorable conditions the total loss of nutrients is never more than from 5 to 10 per cent. In using earth pits for steamed potatoes the loss in nutrients is never more than from 15 to 20 per cent. With water-tight pits this is reduced to from 5 to 10 per cent.

The spontaneous souring process is not recommended for general use on account of the possibility of infection by pathogenic micro-organisms, which would yield a spoiled product unsafe for use as a feed. The pure culture method, using steamed potatoes which are inoculated with *Bacillus cucumeris fermentati*, *B. lactis acidi*, *B. delbrücki*, or mixed cultures of lactic acid bacteria, is easy and practical and yields the most reliable results.

No difficulty was experienced in feeding the product to animals, preliminary data indicating it to be of great value for milch cows.

Analytical data showing the composition of the potatoes before and at various stages in the souring are also submitted.

Report to the Michigan legislature on the feasibility of using the pulp and chicory dryers in the State to dry the surplus potato crop, A. C. CARTON (*Lansing, Mich.: Pub. Domain Com., 1915, pp. 43*).—This pamphlet reports the findings of the secretary of the Public Domain Commission in his investigation to ascertain the commercial possibilities of dried potatoes or potato flour in the domestic and foreign market, and as to the utilization of the pulp driers in the large sugar and chicory factories.

METEOROLOGY.

The value of high-level meteorological data in forecasting changes of temperature: A contribution to the meteorology of Mount Rose, Nevada, S. P. FERGUSSON (*Nevada Sta. Bul. 83 (1915), pp. 30, figs. 10*).—This bulletin, which supplements an earlier one of the station (E. S. R., 21, p. 14), reports "the results of a study of meteorological phenomena at different heights, undertaken with the object of determining, if possible, the value of upper-air data in forecasting frost. The material employed chiefly consists of records obtained simultaneously on the summit of Mount Rose and at stations in near-by

valleys. Analyses of these records have been compared with results of similar researches conducted elsewhere."

Summarizing the results the author concludes that "the general relation or connection between the conditions recorded at the summit and base stations of Mount Rose appears to be practically the same as that found to exist between the summit and base stations of mountains in other parts of the world. Of the decided falls of temperature or cold waves occurring on the summit during four years of observation, about one-half were accompanied by nearly synchronous changes at the base stations; one-third were followed within 48 hours by lower minimum temperatures at the base stations; one-fifth were followed by a slight rise of temperature at the base stations. In the instances where cold waves on the summit precede those at the base, particularly those where a rise of temperature occurs at the base, the cause is probably local gradients less steep than usual, mechanical cooling of the air at the summit during a strong wind, or clouds or fog in the valleys and below the summit. Such a condition, however, does not appear to be a very stable one and probably can not exist very long. Abnormal falls of temperature or cold waves occur most frequently when a cyclone or area of low pressure is about 500 miles south or southeast, and an anticyclone or area of high pressure about 300 miles northwest of Mount Rose. When well-defined cyclones and anticyclones pass over or near Mount Rose, the changes of temperature at the summit and base are nearly synchronous, for at such a time the winds at all levels are higher than normal and the atmosphere more nearly homogenous."

While the author believes that data from high-level stations, such as are reported in this bulletin, will be found valuable in local forecasting, they should be supplemented by determinations, in some level region, of "the vertical gradients or distribution of the chief meteorological elements by means of recording instruments elevated by kites and balloons and from observations of the formation and movements of clouds. . . . Comparisons of free-atmosphere data with observations on mountains and in valleys under various conditions of weather will show the relation of local phenomena to the general movements of the atmosphere."

It is urged that the practical utility of the results of such investigations can be greatly increased by embodying the information in courses of instruction.

Report of the chief of the Weather Bureau, 1915 (*U. S. Dept. Agr., Weather Bur. Rpt. 1915, pp. 276, pls. 4*).—This report follows the general lines of previous years (E. S. R., 32, p. 810).

Among the subjects of special interest briefly discussed in the summary report are the progress and present status of snow surveys in mountain watersheds in Utah, Idaho, Wyoming, and Arizona which are being carried on as a means of measuring the water which may later be available for irrigation; a preliminary trial of a scheme of utilizing amateur wireless operators in the distribution of weather forecasts; improvement of the system of storm warning signals on the Great Lakes; and observations on the extent and damage caused by floods.

"The heavy and continued rains of May and June, 1915, in Kansas, Nebraska, and adjoining sections, while not producing marked floods in the rivers, nevertheless wrought immense damage to standing crops, not only from overflow and total destruction along the rivers and small streams, but also by reason of the saturated condition of the soil, it being impracticable to gather crops until the ground dried out. An estimate of the damage to crops and farm lands in Kansas places the amount at $6,000,000, with an additional $1,500,000 along the Missouri east of Kansas City."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 3 (1916), Nos. 3, pp. 239, pls. 2, figs. 6; 4, pp. 228,*

pls. 2, figs. 6).—These numbers contain, respectively, brief summaries and detailed tabular statements of climatological data for each State for March and April, 1916.

Climatology of State College, Pennsylvania.—II, Precipitation (rain and snow), W. FREAR (*Pennsylvania Sta. Rpt. 1914, pp. 233–347*).—This is an elaborate discussion of precipitation at State College, Pa., based upon observations from 1880–1913, inclusive. It supplements a similar discussion of the temperature of this place published in a previous report (E. S. R., 34, p. 115).

The records show that the locality belongs to the common class as regards hours of greatest rainfall frequency, namely, that in which rains are least frequent in the hours immediately preceding noon. "The larger precipitation in the afternoon as compared with the morning division of the late spring and summer days is due both to the greater frequency of the rainfall at that time of day, and also to the greater average quantity of the afternoon as compared with the morning rains. In like manner, the night time precipitation is on the average greater than that at other times of day during the remainder of the year, and for the same reason—that the night rains are then the more frequent and more copious." The summer daytime precipitation is about one-half greater than that occurring by night when the total precipitation through the period is considered.

"Considering the number of rainy days in the year, as indicated by the occurrence of measurable precipitation, 1886 with 99 days had the least, and 1911 with 157 days, the most. The average for all years was 130.3 days, or about 4.3 days out of twelve."

The largest precipitation occurred in the summer months; the smallest in the winter. The data give no support to the popular idea of the relation of rainstorms to holidays or to equinoxes.

The average annual rainfall for the period was 39.762 in., and this was distributed by seasons approximately as follows: Winter 8.82 in., spring 10.52 in., summer 11.76 in., and autumn 8.38 in. There was no regularity of annual precipitation. "Of the 30 years for which the records are complete, the annual total falls below the average in 13 cases, and exceeds it in 17 cases. The extreme range is from 30.845 in. in 1887 to 46.545 in. in 1891, a range of 15.7 in., which is more than half of the minimum. The mean between the extremes is 38.695 in., or 1.067 in. below the average." For one-half of the years the annual average was above 40 in.

As regards unsettled weather the winter and spring months showed the greatest frequency and the summer months least. Dry spells, that is, periods of 14 days or more in which less than 0.1 in. of rain fell, were very irregularly distributed among the months, but the last four months of the year showed them in the greater frequency. "That is, the dry spells are most frequent at the season when the number of crops that can be directly affected is least. May stands next in the order of frequency, and represents a critical period in the life of the majority of farm and garden crops, but June had but one dry spell in the thirty years for which the detailed records are at hand; so that it tends, on the average through many years, to compensate for the May fickleness of water supply."

The average seasonal snowfall for the period was 47.18 in. It ranged from 18.01 in. in the winter of 1888–89 to 83.14 in. in the winter of 1907–08. The greatest snowfall of a single month was that of February, 1908, when 41.8 in. fell. The ratio of rainfall to snowfall of the winter season was as 74 of the former to 26 of the latter. The greatest snowfall in any one day was 17.5 in., March 5, 1902.

Meteorology for 1913, H. D. EDMISTON (*Pennsylvania Sta. Rpt. 1914, pp. 390–399, 497–518*).—The observations here recorded are of the same character as those reported in previous years (E. S. R., 34, p. 118). The summary for 1913 is as follows:

Summary of meteorological observations at State College, Pa., 1913.

Kind of observation.	1913	Growing season (April–September).
Barometer (inches): Mean	30.02	
Temperature (°F.):		
Mean	50.6	62.6.
Highest	93.0 (July 1)	93.0 (July 1).
Lowest	4.0 (Feb. 2, Mar. 7)	25.0 (Apr. 8).
Greatest daily range	37.0 (June 11)	37.0 (June 11).
Least daily range	33.0 (Apr. 28, Dec. 3)	
Rainfall (inches)	39.83	18.36.
Number of days on which 0.01 in. or more rain fell	127	59.
Mean percentage of cloudiness	49.4	44.3.
Number of days on which cloudiness averaged 80 per cent or more.	79	30.
Last frost in spring		June 10.
First frost in fall		Sept. 9.

Ohio weather for 1915, J. W. SMITH and C. A. PATTON (*Ohio Sta. Bul. 296 (1916), pp. 349–428, figs. 61*).—The temperature and precipitation throughout the State during each month are shown in charts. The usual summary tables are given showing temperature and rainfall at Wooster and throughout the State (1888 to 1915).

The mean temperature for the year at Wooster was 48.9° F.; for the State, 50.8°. The highest temperature at the station was 91°, July 16; for the State, 99°, July 31. The lowest temperature at the station was −13°, January 24; for the State, −22°, January 24. The annual rainfall at the station was 42.06 in.; for the State, 40.83 in. The number of rainy days at the station was 132; for the State, 123. The prevailing direction of the wind was southwest at the station and in the State at large.

SOILS—FERTILIZERS.

Soil survey of Polk County, Georgia, D. D. LONG and M. BALDWIN (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 46, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture and issued July 5, 1916, deals with the soils of an area of 200,320 acres, comprising parts of the Appalachian and Piedmont Plateau provinces in northwestern Georgia. The greater part of the county is rolling to hilly. Drainage is said to be generally well established. The soils of the area are of residual, alluvial, and colluvial origin. Exclusive of rock outcrop, 31 soil types of 16 series are mapped, of which the Clarksville gravelly loam and the Talladega slate loam cover 33 and 10.1 per cent of the area, respectively.

Soil survey of Jessamine County, Kentucky, R. T. ALLEN (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 20, fig. 1, map 1*).—This survey, issued June 24, 1916, deals with the soils of an area of 110,080 acres in the bluegrass region of east-central Kentucky.

"In the southwestern part the county is hilly and broken, while the northern section is predominantly gently rolling. . . . In general the county is well drained." "The upland soils . . . comprising about 95 per cent of the area, are residual from limestone, except in some comparatively small areas

in the southwestern section, where they are derived from sandstone." Including rough stony land, seven soil types of five series are mapped, of which the Hagerstown silt loam covers 77.8 per cent of the area.

Soil survey of Gage County, Nebraska, A. H. MEYER, R. R. BURN, and N. A. BENGTSON (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 42, fig. 1, map 1*).—This survey, made in cooperation with the Nebraska Soil Survey and issued June 10, 1916, deals with the soils of an area of 547,840 acres in southeastern Nebraska lying entirely within the glaciated part of the Great Plains province.

"The topography ranges from almost flat or plainlike to rolling, with steep to abrupt slopes along drainage ways, bordered by rather high rock ledges. As a whole the county is well drained." "The soils of the county are classed, on the basis of origin and mode of formation, into four principal groups, (1) soils derived from loess, (2) soils derived from glacial drift, (3) residual or or partly residual soils, and (4) alluvial soils." Excluding meadow, ten soil types of ten series are mapped, of which the Carrington, Grundy, and Wabash silt loams cover 51.4, 18.4, and 14.7 per cent of the area, respectively.

The soils and agricultural development of northern New York, E. O. FIPPIN (*Cornell Countryman, 13 (1916), No. 7, pp. 570–575, figs. 4*).—This article deals briefly with the soil characteristics and agricultural conditions of an area of approximately 14,500 square miles, including all of eight counties and parts of six counties in northern New York. The topography is that of a great central mountainous dome receding to low plains. The soils consist of nonagricultural mountain soils, lowland soils, and lake and terrace soils. It is stated that drainage is the most pressing need of these soils and that liming is also necessary.

Soil survey of Wake County, North Carolina, L. L. BRINKLEY, N. M. KIRK, R. T. ALLEN and B. B. DERRICK (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 45, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture and issued June 30, 1916, deals with the soils of an area of 537,600 acres lying in the Piedmont Plateau and Coastal Plains regions in central North Carolina. The topography ranges from level to hilly and broken. The county is said to be well drained. The soils are of residual and sedimentary origin. Twenty-two soil types of nine series are mapped, of which the Cecil sandy loam, Durham coarse sandy loam, and Cecil coarse sandy loam cover 21, 14.3, and 10.4 per cent of the area, respectively.

Soil survey of Geauga County, Ohio, C. N. MOONEY, H. G. LEWIS, C. W. SHIFFLER, and O. GOSSARD (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 37, fig. 1, map 1*).—This survey, made in cooperation with the Ohio Experiment Station and issued June 30, 1916, deals with the soils of an area of 263,680 acres in the Allegheny Plateau region in northeastern Ohio. The surface varies from flat or nearly flat to gently undulating or rolling and hilly.

"The soils are predominantly silty. They are of glacial origin and derived largely from sandstones and shales of Carboniferous age. According to topographic position and mode of formation the soils fall into three general groups—glacial upland, or unmodified till soils; glacial-lake and river-terrace, or modified till soils; and river flood plain or alluvial soils, with muck and peat, a cumulose formation." Including muck and peat, 16 soil types of eight series are mapped, of which the Volusia clay loam and loam cover 61.7 and 11.4 per cent of the area, respectively.

Some alkali soils in Ohio, J. W. Ames (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 209, 210*).—It is stated that the areas of alkali soils in Ohio are located in the southern part of Highland County and in Brown and Clermont counties. Examination of the alkali soil in one case showed contents of magnesium, aluminum, and sulphur equivalent to 4.27 per cent magnesium sulphate and 4.9 per cent aluminum sulphate.

Soil survey of Frederick County, Virginia, J. B. R. Dickey and W. B. Cobb (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 48, pls. 4, fig. 1, map 1*).—This survey, issued June 22, 1916, deals with the soils of an area of 274,560 acres in northern Virginia. The county is divided into valley and hill regions, the topography of the former being undulating to rolling. The hill country has excellent surface drainage.

The soils of the county fall into three broad general divisions. "The most extensive division comprises the soils of the Appalachian Mountain province, or the soils derived from shales and sandstones, while the most important agriculturally is that group of soils found in the limestone valley province, All the soils in these provinces are, with possibly one exception, residual. . . . The third division includes the alluvial soils." Including rough stony land, 19 soil types of nine series are mapped, of which the Dekalb gravelly loam, Berks shale loam, and Hagerstown clay loam cover 24.3, 18, and 10.1 per cent of the area, respectively.

The loess soils of the Nebraska portion of the transition region.—I, II, F. J. Alway et al. (*Soil Sci., 1 (1916), No. 3, pp. 197–258, pls. 3, figs. 6*).—Two papers are presented.

I. *Hygroscopicity, nitrogen, and organic carbon,* F. J. Alway and G. R. McDole.—Studies, made at the Nebraska Experiment Station, of the hygroscopicity and nitrogen and organic carbon contents of 648 samples of soils, representing the first six foot sections and the 12 inch sections of the surface foot from five virgin prairie fields in each of six areas in Nebraska located between the Missouri River and the western limit of the loess region in which the annual precipitation decreases from more than 30 in. in the east to less than 20 in. in the west and the relative aridity exhibits a still greater range, are reported.

It was found that "the hygroscopicity, as expressed by the hygroscopic coefficient, is strikingly uniform both from field to field in any one area and from the surface downward in the same field. It is lowest in the two western areas and highest in the two eastern. When the different levels from the individual fields are compared, the highest is found in either the second or the third foot, in which two it is very similar. The minimum value is found in the surface foot of the three eastern areas, and in the sixth of the three western. . . .

"The effect of the organic matter upon the hygroscopicity is too slight to be detected, a change of even 100 per cent in the content of this being without distinct influence. The nitrogen content in all the fields decreases from the surface downward. In the surface foot . . . it decreases steadily, there being in general about half as much in the twelfth as in the first inch section. The nitrogen in the surface foot decreases by about 50 per cent from the most easterly to the most westerly fields, the difference being such as to permit a definite grouping of the areas. The most easterly areas show as high a content in the second foot as do the most westerly in the first. In this level also there is a decrease from east to west, but it does not show the gradual change exhibited in the first foot. In the . . . third to sixth foot . . . the differences are small. . . . The organic carbon in the surface foot is very similar in distribution to that of the nitrogen. The amount of the former is approxi-

mately twelve times that of the latter, the ratio being uninfluenced by the aridity of the climate. When the inch sections of the surface foot are considered the organic carbon decreases slightly more rapidly than does the nitrogen, the average ratio being 13.4 for the first and 11.3 for the twelfth inch section. In the levels below the first foot also a similar difference in the rate of decrease is observed, the ratio in some cases falling as low as 6. The decrease is less rapid in the western than in the eastern areas, the average organic carbon content in the fourth, fifth, and sixth feet being higher in the two most westerly areas than in the two most easterly, while that of the nitrogen is lower. The decrease in nitrogen and organic carbon in the surface soil from east to west . . . [is] attributed to the greater vegetative growth without a correspondingly more rapid decay in the eastern areas.

"The water of constitution (the difference between volatile matter and organic matter) decreases from east to west, the variations being concordant with those in the hygroscopicity. Compared with the Russian chernozem soils formed on loess, the organic carbon and the nitrogen are low both in the surface soil and in the subsoil, the amounts found in the eastern areas being similar to the minima reported for the chernozem. The subsoils from the semiarid areas, in so far as the nitrogen is concerned, in contrast with the arid subsoils, are as 'raw' as those from the humid areas, not supporting a satisfactory growth of nonleguminous plants."

A list of 26 references to literature bearing on the subject is appended.

II. *Humus, humus-nitrogen, and color*, F. J. Alway and M. J. Blish.—In this report of studies of the humus-nitrogen and color of the soils described in the foregoing article, "the gravimetric method for the determination of humus was found in the case of the subsoils to fail to indicate the relative amounts of ammonia-soluble, dark-colored organic matter present. A colorimetric method is preferable for the subsoils; in the case of the surface soils it is at least fairly satisfactory for the determination of the whole of the ammonia-soluble organic matter.

"Within the surface foot the humus decreases from the first to the twelfth inch and from east to west. The rate of decrease downward is independent of the degree of aridity. In the second foot the decrease from east to west is less marked than in the first, while in the still lower levels the humus, as determined gravimetrically, shows no distinct change from east to west. No marked differences in the percentage of nitrogen in the humus were found between the soils from the most humid and those from the most arid parts of the region. The soluble pigment in the surface foot was found to decrease in passing from east to west, while that in the third to sixth foot increases. A relatively low amount in the surface foot with a relatively high content in the subsoil characterizes the soils from the more arid portion of the region.

"The colors of the soil and subsoils agree in general with the amounts of soluble pigment found by the colorimetric method. . . . The color of the soils in the western areas is lighter, and in all the areas the dark-colored surface layer is shallower than in the typical Russian chernozem. Buried soil surfaces as well as the dark tongues and veins, common in the Russian chernozem, appear to be absent in the loess of the Nebraska portion of the transition region. Gravimetric determinations show the humus of the soils of the western semarid areas to be similar in amount and in distribution to that of typical arid California soils."

A list of 12 references to literature bearing on the subject is appended.

[Composition of caliche], A. E. Vinson and C. N. Catlin (*Arizona Sta. Rpt. 1915, pp. 567, 568*).—Analyses of five samples of caliche are reported, the results

of which are taken to indicate that this soil is well supplied with potassium and phosphorus and that its potassium-sodium ratio is similar to that found in limestone.

Soil colloids, W. T. McGeorge (*Hawaii Sta. Rpt. 1915, pp. 36, 37*).—Attention is called to the invariable presence of colloidal aluminum hydroxid in Hawaiian soils of high aluminum content. "In all soils which contain iron in excess of alumina, this colloidal gel is never formed."

Absorption and solution of ammonium and phosphate salts, H. Stratmann (*Über Absorption und Lösungen von Ammonium und Phosphatsalzen. Diss. Univ. Giessen, 1914, pp. 62, figs. 2*).—The work of others bearing on the subject is briefly reviewed, and experiments with a number of soils of different mineralogical origin and composition, including loamy alluvial soils poor in lime, clay, loess, blow sand, stony loam poor in lime, ortstein, marly soil, slaty clay soil, sericite, slate soil rich in potash, weathered gray wacke soil, weathered granite soil, diabase soil, weathered phonolite, basaltic soil, and diluvial sand soil are reported. The purpose was to determine the extent to which the absorptive power of a soil for ammonia and phosphates is influenced by decreasing its content of colloidal material. Solutions of ammonium chlorid and sulphate of concentrations equivalent to 200 cc. of nitrogen per 200 cc. of solution and solutions of monocalcium phosphate, dicalcium phosphate, and diammonium phosphate of a concentration equivalent to 492 mg. of phosphoric acid per 400 cc. of solution were used.

It was found that in mechanical soil analysis the sedimentation of the fine colloidal particles was not a function of the time or the size of the particle, making the results obtained by the decantation method more or less dependent on an unknown factor. The Schön process was found to be more reliable than the decantation process and in modified form was more simple. The absorptive powers of soils of different origin and composition were influenced in a variable manner by the removal of the finest particles, according to the kind of spar sand present. The silicon dioxid present in some basaltic soils, especially in the group of particles of a diameter varying from 0.05 to 0.03 mm., was found to be a new formation from the weathering of bauxite. The components of so-called double silicates were found only in small amounts in many soils of noteworthy absorptive powers. Synthetic silicates could not be characterized as double silicates. Chabazite and stilbite minerals of the zeolite group were found to be acid salts. Kaolin, as an acid aluminum silicate, is considered to be fundamentally different from the amorphous aluminum silicates of the soil. The main substance partaking in soil absorption and exchange of ions is considered to be amorphous aluminum silicate, which is the end product of the normal weathering of feldspar.

The influence of a stand of trees on the content of dissolved salts in an upland moor soil, E. Ramann and H. Niklas (*Ztschr. Forst u. Jagdw., 48 (1916), No. 1, pp. 3–11*).—Two years' tests of the concentration of the solutions of an upland peat moor soil supporting a stand of birch, pine, and other trees are reported, using the electrical conductivity method.

It was found that the soluble salt content of the forested soil was generally larger than that of the bare soil and was less only in the fall. The variation in salt content of the soils was the same for both years. The salt content was rather low in May, increased until July, and then decreased until September. It increased in November to its greatest height. Laboratory tests of the dead leaves led to the conclusion that the rise in salt content in the soils in November was due to leaching out of the soluble salts in the dead leaves.

A preliminary statement on the present status of the humus nitrogen problem in arid soils, C. B. Lipman (*Soil Sci., 1 (1916), No. 3, pp. 285–290*).—The author reviews experimental work by himself and others conducted for the most part at the University of California.

The results are taken to indicate that "the method of determining humus nitrogen in the ammonia extract of soils is a seriously faulty one, no matter how much care is employed in boiling the extract with magnesia. The method is so faulty as to deserve immediate rejection by all those who are at all concerned with the correct determination of nitrogen in humus. If the results given are considered in connection with the largest part of the humus nitrogen data furnished by Loughridge [E. S. R., 34, p. 324], there can be no question that the prevalent belief in the high nitrogen content of the humus of arid soils is in error. The facts in hand do not justify any belief in the higher nitrogen content of the humus in either the arid or the humid group of soils over each other."

A list of five references to literature bearing on the subject is appended.

A contribution to the subject of the factors concerned in soil productivity, C. Hoffmann (*Kans. Univ. Sci. Bul., 9 (1914), No. 7, pp. 79–99, pls. 5*).—Laboratory experiments conducted at the University of Wisconsin with normal peat, sandy, and marsh soils to determine (1) the influence of the growth of pure cultures of soil organisms in sterile soil on the growth of wheat, corn, and clover seedlings in the extract of such soil, and (2) the influence of the growth of corn, oats, and clover in the same soil on pure cultures of bacteria grown in the extracts of such soil are reported.

It was found that "the growth of individual species of bacteria in a soil produces changes in the soil solution which manifest themselves by an increased or decreased development of plant seedlings when grown in extracts made from such soils. Invariably this influence seems to affect the root development rather than the leaf development. In repetitions of the same experiment consistent results are secured as long as all three factors, soil, bacterial species, and crop, are the same. A change of any one factor modifies the results secured. The growth of individual species of crops in a soil produces changes in the soil solution which manifest themselves by an increased or decreased bacterial multiplication in extracts made from such soils. The extracts made from a marsh soil cropped by corn, oats, or clover in all cases stimulated bacterial multiplication. This stimulation was consistently greatest in the case of the corn-cropped soil. In contrast to the marsh, the extracts from the cropped loam and sand soils invariably retarded the multiplication of the bacteria grown in the same. There is a definite relation between the growth of crops in soil and the growth of bacteria therein. . . .

"Owing to the variability of the three factors involved, soil, crop, and bacterial flora, it is impossible to establish any hard and fast laws for all cases."

Incubation studies with soil fungi, S. A. Waksman and R. C. Cook (*Soil Sci., 1 (1916), No. 3, pp. 275–284, fig. 1*).—Ammonification experiments conducted at the New Jersey Experiment Stations with *Mucor plumbeus*, *Penicillium* sp., and *Monilia sitophila* in pure culture in a gravelly loam soil, using dried blood and cotton-seed meal as ammoniates, are reported.

The results obtained are taken to indicate that "optimum moisture conditions for ammonia accumulation by fungi lie near the physical optimum. The proper incubation period depends entirely upon the organism. A 12-day incubation period is preferable to a shorter one for practical work. A correlation exists between the biological stage of the organism and the periods of ammonia accumulation; the largest amount seems to accompany the periods of spore

germination and the smallest amount the time preparatory to actual spore formation. *M. sitophila* shows the largest ammonia accumulation within the first 3 or 4 days; *Penicillium* sp., between 10 and 15 days; and *M. plumbeus*, between 6 and 10 days. These periods correspond to those of active spore formation for the respective organisms."

Preliminary experiments on some effects of leaching on the soil flora, C. B. LIPMAN and L. W. FOWLER (*Soil Sci., 1 (1916), No. 3, pp. 291–297*).—Preliminary laboratory experiments conducted at the University of California on the processes of ammonification, nitrification, nitrogen fixation, and cellulose decomposition in clay loam and blow-sand soils when unleached and leached in the presence or absence of 0.1 per cent sodium chlorid, 0.25 per cent sodium sulphate, 0.05 per cent sodium carbonate, or a combination of 0.1 per cent sodium chlorid, 0.05 per cent sodium carbonate, and 0.1 per cent sodium sulphate, are reported.

The results obtained are taken to indicate that "leaching affects the bacterial flora of soils profoundly. . . . This is particularly so for the nitrifying, nitrogen-fixing, and cellulose-destroying organisms. All of these processes appear to be wholly or almost wholly checked by leaching, especially if salts are present prior to the execution of the latter process."

A list of seven references to literature bearing on the subject is appended.

Nitrification in relation to the reaction of the soil, J. W. WHITE (*Pennsylvania Sta. Rpt. 1914, pp. 70–80, pls. 4*).—Studies of nitrification and the nitrate content of acid soils and soils made acid, especially by treatment with ammonium sulphate, are reported, the results of which are taken to indicate that nitrification does not cease in very acid soils. Soil on which corn and wheat failed was found to be liberally supplied with nitrates.

"The absence of nitrates under growing plants is no indication of the inactivity of nitrifying organisms. The variation in nitric nitrogen content of all areas on ammonium sulphate plats is parallel to the unequal distribution of vegetation. An average plat showed 24.91 parts per million of nitric nitrogen in corn stubble, 13.14 parts per million on clover sod, 9.23 parts per million under clover and timothy, and 36.47 under winter wheat."

Applications of burned lime and ground limestone to soil from the plat materially stimulated the activity of nitrifying organisms. Magnesian lime gave higher nitrates than pure lime. Failure of clover, corn, and wheat was "not due to the absence of available nitrogen as nitrates. . . . On the basis of 256 nitric nitrogen determinations, indications are that nitrification is still active on the very acid soils of the ammonium sulphate plats."

The effect of 1.14 in. of rainfall upon the nitric nitrogen and acid content of plat 32, J. W. WHITE (*Pennsylvania Sta. Rpt. 1914, pp. 67–70*).—Studies of evaporation from a soil during a period of drought and of the capillary movement of water-soluble nitrogen and acids or acid salts before and after a heavy rainfall are reported.

It was found that "the 1.14 in. of rainfall penetrated the soil to a depth of 15 in. There was a total loss of 4 per cent of moisture from the surface soil [growing wheat] between August 18 and September 6." The moisture content of the surface 3 in. of soil, as the result of 1.14 in. of rain September 21, increased in corn soil from 7.11 to 18.86 per cent, in clover soil from 8.72 to 17.02 per cent, and in wheat soil from 6.31 to 16.76 per cent. The corn soil "showed an enormous accumulation of nitrates where corn failed. The difference in nitric nitrogen content of the three areas studied is due for the most part to the presence or absence of vegetation.

As the result of the rain there was a loss of nitrogen from the corn soil as follows: 0 to 3 in., 80.75 lbs. per acre; 0 to 6 in., 61 lbs. per acre; and 0 to

24 in., 68.86 lbs. per acre. "Plat 32 shows considerable accumulation of soil acids to a depth of 24 in. At this depth there was found in [the corn soil] 3,221, [clover soil] 1,800, and [wheat soil] 2,500 lbs. per acre 7 in., expressed in terms of calcium carbonate required to neutralize the acids present. The decrease in the acid content of the surface 3 in. before and after the rain was as follows: [Corn soil] 1,661, [clover soil] 1,152, and [wheat soil] 847 lbs. per acre, expressed in their calcium carbonate equivalent."

Stimulating influence of arsenic upon the nitrogen-fixing organisms of the soil, J. E. GREAVES (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 11, pp. 389–416, figs. 5*).—In addition to the findings noted in a previous report (E. S. R., 32, p. 720), this report, prepared at the Utah Experiment Station, brings out that "arsenic can not replace phosphorus in the vital process of the nitrogen-fixing organisms, but it can in some manner liberate the phosphorus from its insoluble compounds. This may be either a direct or an indirect action. Arsenic stimulates the cellulose ferments, and these in turn react upon the activity of the nitrogen-fixing organisms. The nitrogen-fixing powers of soil extract, of filtered soil extract, and soil dried for some time are only slightly stimulated by arsenic, showing that arsenic acts mainly by the removal of a thermolabile body which occurs in the soil."

Can soil be sterilized without radical alteration? D. A. COLEMAN, H. C. LINT, and N. KOPELOFF (*Soil Sci., 1 (1916), No. 3, pp. 259–274, figs. 2*).—Preliminary experiments conducted at Rutgers College on clay-loam soil to determine (1) the effect of intermittent sterilization of soil by dry heat, (2) the relative sterilizing efficiencies of volatile chemical substances when used as soil antiseptics, and (3) the effect of volatile antiseptics applied in partial vacuum and under pressure at 80° C., are reported.

It was found that "intermittent sterilization by means of dry heat at 82° for five successive days in moist soil almost completely decimated the bacterial flora of the soil. This was accomplished with but a slight change in the chemical constitution of the soil, as indicated by the amount of water-soluble solids. Ordinary steam sterilization under pressure causes a change 16 times as great. There is a strong indication that the application of volatile antiseptics either in partial vacuum or under a combination of heat and pressure, if repeated for more than three successive days, would achieve complete soil sterilization without involving any radical alteration in the chemical constitution of the soil."

A list of 14 references to literature bearing on the subject is appended.

The effect of partial sterilization on plant growth, W. T. MCGEORGE (*Hawaii Sta. Rpt. 1915, pp. 37, 38*).—Pot experiments with red clay and a sandy soil high in organic matter growing onions, millet, and cowpeas are reported. "These soils were treated as follows: Heated in sunlight, in an oven at 80, 110, and 165° C., and in an autoclave at 10 lbs. pressure. Those heated in the oven were left for two hours, that in the autoclave for only one hour. In addition, soils were treated with the following antiseptics at the rate of 10 cc. per kilogram: Carbon bisulphid, chloroform, and toluene. . . .

"The influence of partial sterilization upon onions was very marked. Volatile antiseptics produced a [marked] increase, while heating in the autoclave was productive of a substance evidently toxic toward this plant. An increase in vigor of the millet plant was correlated with an increase in temperature at which the soil was sterilized. The plants are more vigorous in the pots sterilized by heat than those sterilized by antiseptics. It appears that the organic substance having a toxic influence upon onions is without effect upon millet, for in the pot heated in the autoclave the plants are as vigorous as any others.

"In case of cowpeas, the increase in temperature at which the soils were sterilized resulted in a steady decrease in vigor. While the volatile antiseptic low-

ered the vigor to a slight extent, their influence is not so marked as heat. These results clearly show the intimate relationship between leguminous plants and bacterial life in the soil."

Variation in the growth of clover on Mitchell field (A), J. W. White (*Pennsylvania Sta. Rpt. 1914, pp. 65, 66, pls. 2*).—Studies of the lime requirement, the contents of acid-soluble calcium and magnesium oxids and phosphoric acid, and the total nitrogen of a soil in a field where clover grew both well and poorly showed that the irregular growth of the clover was due to the unequal distributions of basic material which controls the reaction of the soil.

"The growth of clover and the lime requirement are in close accord. No other one factor bears such a close relation to the growth of clover. . . . [Considering] the sum of the lime and magnesia, which forms the determining factor so far as the reaction of the soil is concerned, the two bear relations parallel to the lime requirement, though in an opposite direction. . . . The limit of acidity may vary with the fertility of the soil, or possibly with a difference in the kind of free acid present."

Soil management problems (*Wisconsin Sta. Bul. 268 (1916), pp. 26–32, figs. 4*).—The general results obtained in experiments on the management of silt loam, clay, and sandy soils, the effect of cultivation on soil acidity, the correction of soil acidity with limestone waste from lead and zinc mines, fixation of nitrogen in acid soils, and nitrate formation in different soil types are briefly noted.

[Reclamation of alkali soils], J. H. Barnes (*Rpt. Dept. Agr. Punjab, 1915, App., pp. IV, VI–IX*).—Studies of nitrogen fixation, ammonification, nitrification, and carbon dioxid production in barren alkali soils at Narwala in the Punjab district before and after mole drainage, cultivation, and flooding with canal water are reported in tabular form, showing a marked increase in bacterial activity following such treatment.

[Soils and fertilizers], N. H. J. Miller (*Ann. Rpts. Prog. Chem. [London], 12 (1915), pp. 211–233*).—This section summarizes the results of recent investigations relating to soils and fertilizers.

Effect of fertilizers on soil structure as indicated by the draft of a plow, C. F. Noll (*Pennsylvania Sta. Rpt. 1914, pp. 36–46, pls. 2*).—Dynamometer tests made on plats of clay and silt loam soil, treated since 1882 with commercial fertilizers, lime, manure, lime and manure, and land plaster are reported.

"The plats are divided into four series or tiers of 36 one-eighth acre plats each, on which are grown each year in rotation, in the order named, corn, oats, wheat, and mixed clover and timothy. The dynamometer tests were begun in the fall of 1911 and were repeated each time a tier of plats was plowed. Three series of tests were made in plowing sod, three in plowing corn stubble, and three in plowing oat stubble. . . . On each plat two tests were made at one plowing near the ends of the plats and each was for a distance of about 50 ft."

It was found that "the fertilizer treatment has had little influence on the soil structure. The nitrate of soda applied at the rates of about 160, 320, and 480 lbs. per acre has not materially affected the physical properties of the soil. The draft has been about the same on four manured plats as on complete commercial fertilizer plats alternating with them. The presence of more organic matter in some of the soils has slightly lightened their draft."

Meadow fertilization experiments, M. Stein (*Deut. Landw. Presse, 43 (1916), No. 21, pp. 178–180*).—Five years' experiments on loamy sand, loam, humus sand, marshy sand, and shallow mountain meadow soils of seven different localities of the Province of Saxony are reported.

It was found that artificial fertilization with potash and phosphoric acid in general improved the quality and increased the yield of the crop. When nitrogen fertilization was also employed, especially on grass, the yield was further increased. Nitrogen fertilization improved grain crops, but continued fertilization with potash and phosphoric acid alone generally became gradually injurious. On poorly drained soils fertilization had little effect.

Fertilizer ratio experiments with grass on Hagerstown loam, C. F. Noll, O. Schreiner, and J. J. Skinner (*Pennsylvania Sta. Rpt. 1914, pp. 22–36, pls. 2*).—Field experiments in which acid phosphate, sodium nitrate, and potassium chlorid were applied to silt loam soil for four years in 66 different fertilizer ratios of phosphate, nitrate, and potash graded in 10 per cent stages are reported. "The total amount applied on each plat totaled 50 lbs. per acre of the fertilizer elements, P_2O_5, NH_3, and K_2O alone or in combinations of two or three of these. The plats were located in a permanent pasture field where the composition of the pasture was chiefly Canada blue grass, Kentucky blue grass, and timothy with a very little white clover and red clover."

The various phases of the results obtained are presented by means of the triangular diagram employed by the Bureau of Soils of the U. S. Department of Agriculture in solution culture experiments in studies of organic soil constituents (E. S. R., 24, p. 32; 26, p. 224).

It was found that "used alone, nitrate has given a large increase over the untreated plats in yield of hay, while both phosphate and potash have yielded a little less than the checks. With increase in percentage of NH_3 applied as nitrate, the yields have increased, and with increase in percentage of either P_2O_5 or K_2O the yields have not increased. The plats [receiving] 50 per cent or more of NH_3 as nitrate have considerably exceeded in yield those in the subtriangles which have received 50 per cent or more of P_2O_5 or K_2O. There has been a slightly greater response from K_2O than from P_2O_5. The slight differences in the texture of the soil on the different plats have had little influence on the yields. The depth of surface soil has had a marked influence upon the yield."

Legumes as green manure, W. T. McGeorge (*Hawaii Sta. Rpt. 1915, pp. 32, 33*).—Pot experiments made by A. R. Thompson with a calcareous soil and a soil poor in lime in which 32 varieties of legumes were grown are reported. At maturity the duplicate plants in two pots were removed, weighed, and the nitrogen content determined. Two pots were left of each variety of legume planted, the plants being turned under to decompose.

"In all instances the [content of] nitrates in the soil from which the legumes had been removed was much lower than in the check soil, but these soils low in nitrates on standing in the open air soon equaled in nitrate value the soil of the check pots. Where much legume material was turned under the nitrates in the soils were greatly increased. The plants grown in soils deficient in lime made a poor growth and had a lower nitrogen content, calculated on a water-free basis, than the plants grown in soils rich in lime. In a second experiment lime was added to the lime-poor soil, but the plants grown in this soil were also undersized and low in nitrogen."

Legume inoculation and nitrogen fertilization on upland moor meadows and pastures, B. Tacke (*Mitt. Ver. Förd. Moorkultur Deut. Reiche, 34 (1916), No. 3, pp. 37–47*).—Experiments on the possibility and practicability of substituting nitrogen fertilization for inoculation of soil by nodule bacteria for leguminous pasture and meadow crops are reported.

The results are taken to indicate that nitrogen fertilization can replace inoculation only where more or less active nodule bacteria are present in the soil in sufficient numbers and distribution. The substitution of nitrogen

fertilization for inoculation is probably most advantageous in cases where the inoculating substance is difficult to obtain or use at the proper time. Inoculation in every case noted was cheaper than nitrogen fertilization. The advantage of nitrogen fertilization was greater the shorter the time since the soil had been broken.

The influence of the distribution of nitrogenous fertilizers and straw in soil on plant production, B. NIKLEWSKI (*Ztschr. Landw. Versuchsw. Österr., 18* (*1915*), *No. 12, pp. 674–690*).—Pot experiments with oats on a sandy loess soil deficient in plant food to determine the influence of distribution in the soil on the action of sodium nitrate, ammonium sulphate, liquid manure, peptone, and straw are reported.

The influence of nitrogen fertilization on plant production was found to be determined, next to total amount, by its concentration. A greater increase in crop yield was obtained by distributing ammonium sulphate in the soil in a layer than by mixing generally a double quantity with the soil. The favorable influence of distribution in a layer was especially marked when using the smaller amounts, a saving being thereby obtained.

The influence of distribution was found to vary with the speed of diffusion of the different fertilizers in the soil, the greatest influence being evident for peptone and the least by sodium nitrate. The effectiveness of a fertilizer was also found to depend not only on its physiological value but also on its speed of diffusion in soil. The influence of the speed of diffusion of a fertilizer could be diminished by distribution in the soil and the value of the fertilizer thereby altered.

By intermixing with soil in lower concentrations the best results were obtained with sodium nitrate, followed in order by ammonium sulphate and peptone. By placing in the soil in a layer in higher concentrations the best results were obtained with peptone, followed in order by ammonium sulphate and sodium nitrate.

The concentration of the fertilizers appeared to influence strongly the microbiological processes of the soil and also plant development.

The straw had an unfavorable influence on the utilization of ammonium sulphate in lower concentrations and a favorable influence in higher concentrations. This result is considered an important factor in determining the proper use of liquid manure and the availability of nitrogen in stable manure. Straw had a favorable influence on the utilization of sodium nitrate in lower concentrations, but was without influence in higher concentrations. Straw hastened the diffusion of sodium nitrate in soil, especially in lower concentrations.

Pot fertilizer experiments with new nitrogenous fertilizers, M. POPP (*Mitt. Deut. Landw. Gesell., 31* (*1916*), *No. 4, pp. 54–57*).—Pot experiments with oats on a sandy soil deficient in humus to determine the relative fertilizing values of ammonium nitrate, sodium nitrate, ammonium sulphate, sodium-ammonium sulphate, ammonium bicarbonate, ammonium chlorid, two kinds of urea, urea nitrate, lime nitrogen, and granulated lime nitrogen when added in amounts equivalent to 0.5, 1, 1.5, and 2 gm. of nitrogen per 10 kg. of soil are reported.

With reference to crop yield the best results, not considering lime nitrogen, were given by sodium nitrate, followed in order by ammonium chlorid, ammonium sulphate, urea nitrate, ammonium bicarbonate, ammonium nitrate, urea, and sodium-ammonium sulphate. With reference to both crop yield and nitrogen utilization sodium nitrate again gave the best results, followed in order by ammonium sulphate, ammonium nitrate, ammonium chlorid, urea nitrate, urea, sodium-ammonium sulphate, and ammonium bicarbonate. Urea obtained by synthetic process gave the poorest results in both cases.

It was further found that ordinary lime nitrogen gave considerably less favorable results than ammonium nitrate, while the granulated lime nitrogen in the smallest and medium applications gave results comparable to those obtained by others.

Nitrogen fertilization experiments by the German Agricultural Society in 1914–15, E. RITTER and KLEBERGER (*Mitt. Deut. Landw. Gesell., 31 (1916), No. 3, pp. 30–33*).—Two sets of experiments with oats, potatoes, and beets on 0.125 hectare plats (about 0.31 acre) of deep mild loam, sandy to loamy gravel, mild sandy loam, and heavy clay soils are reported.

In the first set it was found that the lime nitrogen as a part of the basal fertilizer gave generally better results than ammonium sulphate as part of the basal fertilizer on mild and heavy loam, clay, and gravel soils. The results are further taken to indicate that the use of lime nitrogen as a top-dressing for oats is advisable only when necessary.

In the second set, comparing lime nitrogen with ammonium carbonate, the increase in yield of potatoes and beets was greater with increasing nitrogen additions, little difference being observed between the two nitrogenous fertilizers. The best effects of nitrogen fertilization were observed on the gravelly soil. The starch content of potatoes decreased with increasing nitrogen applications. The number of diseased and imperfect potatoes and beets increased with increasing additions of lime nitrogen, and this is taken to indicate that the use of larger amounts of lime nitrogen should be undertaken with caution and only after preliminary local experiments.

A brief note of experiments on the use of catalytic fertilizers with lime nitrogen is also included.

Experiments with nitrogenous fertilizers at the Finnish moor culture experiment station in 1911 to 1913, A. RINDELL (*Finska Mosskulturför. Årsbok, 18 (1914), No. 1, pp. 53–98; abs. in Zentbl. Agr. Chem., 44 (1915), No. 7, pp. 299–302*).—Experiments with oats on moor soil which was first burned and then treated with loam soil at the rate of 150 cubic meters per hectare (79.4 cu. yds. per acre) showed that on such soil both sodium nitrate and stable manure markedly increased the crop yield.

In experiments with burned and unburned moor soil, it was found that the burned soil gave the better results the first year but poorer results thereafter. Nitrogen fertilization was found in further experiments to be profitable in both burned and unburned soil.

Experiments comparing sodium nitrate, ammonium sulphate, and carbid nitrogen for oats showed that the fertilizing value of ammonium sulphate was 83 per cent and of carbid nitrogen 64 per cent of that of sodium nitrate on moor soil. Ammonium sulphate was found to be as good a top-dressing for meadow on loam soil as sodium nitrate, while carbid nitrogen gave less favorable results.

The action of gaseous ammonia on superphosphate and the utilization of the so obtained ammonium phosphate, GERLACH (*Ztschr. Angew. Chem., 29 (1916), No. 3, Aufsatzteil, pp. 13, 14; No. 5, Aufsatzteil, pp. 18–20*).—An ammonium phosphate fertilizer obtained by treatment of superphosphate with gaseous ammonia is described, and pot and plat experiments with oats, barley, and mustard on loamy sand, sandy loam, and sand containing 5 per cent peat are reported, using the ammonium superphosphate mixture and ammonium phosphate obtained by treating the ammonium superphosphate with cold water saturated with carbon dioxid. Analysis of the ammonium superphosphate mixture showed it to contain total nitrogen 7.15 per cent, total phosphoric acid 16.73 per cent, water-soluble phosphoric acid 1.13 per cent, and total lime 24.78 per cent.

It was found in the experiments that the ammonium phosphate gave as good results, both as a nitrogenous and phosphatic fertilizer, as the ammonium-superphosphate mixture.

Availability of mineral phosphates for plant nutrition, W. L. Burlison (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 13, pp. 485–514, pls. 8*).—A review of literature bearing on the subject is given, and 3½ years' experiments conducted at the Illinois Experiment Station on (1) the availability of phosphorus in Tennessee brown rock phosphate for wheat, oats, rye, barley, cowpeas, timothy, red clover, and alfalfa, (2) the comparative productive powers of six mineral phosphates for farm crops, (3) the influence of fermenting dextrose and crop residues on the availability of phosphorus in finely ground rock phosphate, and (4) the influence of the size of particles on the availability of phosphorus in mineral phosphates are reported.

It was found that "phosphorus in rock phosphate can be assimilated by farm crops in sand cultures under greenhouse conditions, even in the absence of decaying residues. Crop residues, when employed in conjunction with brown rock phosphates, were beneficial. Tennessee brown rock phosphate, Florida soft rock phosphate, and Tennessee blue rock phosphate in the heavier applications proved superior to South Carolina land rock phosphate, Utah rock phosphate, and Canadian apatite, for oats, clover, and cowpeas when grown in sand. The phosphorus in brown rock phosphate and Florida soft rock phosphate was more soluble in water and in plant-food solutions than the phosphorus in other mineral phosphates. The superiority of these two phosphates over the others tested is shown chiefly by the first crop.

"Chemical analysis showed that the plant-food solutions applied did not appreciably modify the results. The cereals produced as satisfactory yields as the legumes.

"The crop yields tended to increase as the application of rock phosphate increased up to a point where the size of the pots seemed to be a limiting factor, apatite being the only exception. The plants obtained their calcium, as well as their phorphorus, from brown rock phosphates. No better results were secured when calcium carbonate was applied than when rock phosphate alone was used. There was no particular relation between the citric-acid-soluble phosphorus and the availability of these phosphates for plants. Dextrose, when used as a fermentable substance, was harmful.

"The degree of fineness is a factor which determines to some extent the availability of rock phosphate, as indicated by the brown rock."

A list of 32 references to literature bearing on the subject is appended.

Raw rock phosphate v. acid phosphate, C. E. Thorne (*Mo. Bul. Ohio Sta., 1 (1916), No. 6, pp. 188–192*).—Experience at several of the state experiment stations is reviewed and 20 years' experience at the Ohio Station briefly summarized, from which it is concluded "that raw phosphate rock is a useful carrier of phosphorus and may be used with profit on soils requiring phosphorus; but . . . when raw phosphate and acid phosphate have been used side by side under such conditions as to fully utilize the crop feeding power of the two materials the acid phosphate has generally furnished available phosphorus at a lower cost than the raw phosphate. . . . .

"In the 20-year experiments of the Ohio Station . . . the largest recovery of phosphorus has been three-fourths of that applied in acid phosphate."

The inter-relationships between the constituents of basic slag, S. H. Collins and A. A. Hall (*Jour. Soc. Chem. Indus., 34 (1915), No. 10, pp. 526–530, figs. 3; abs. in Chem. Zentbl., 1915, II, No. 8, p. 431*).—Plat experiments with hay on soil varying from heavy bowlder clay to medium loam, uniformly

deficient in phosphoric acid but rich in humus, are reported, in which 11 different slags were used as fertilizer at the rates of 50 and 200 lbs. of phosphoric acid per acre. The results of analyses of the slags are also reported, and a correlation of these with the citric solubility of the slags and with the results of the plat experiments indicated that phosphate is the most important constituent of slag, while magnesium, manganese, and iron stand second in importance and are of about equal weight. "There seems much reason for supposing that a balance of the secondary constituents is needed. . . . Medium proportions of magnesia, manganese, and iron are all useful, but extra large proportions harmful."

Experiments on the solubility of the phosphoric acid in Thomas meal in water saturated with carbon dioxid, J. G. MASCHHAUPT (*Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefstat.* [*Netherlands*], *No. 17* (*1915*), *pp. 97–141, figs. 5; abs. in Chem. Zentbl., 1915, II, No. 10, p. 552*).—Experiments with 59 samples of Thomas meal are reported, the ratios of Thomas meal to water used being 1:4,000, 1:2,000, 1:1,000, 1:500, 1:250, 1:125, 1:100, and 1:50.

It was found that the amount of phosphoric acid dissolved from Thomas meal by contact with water saturated with carbon dioxid depended in large measure on the ratio of Thomas meal to water. The more narrow this relation was the stronger was the influence of the free calcium oxid and calcium silicate in the Thomas meal on the solubility of the phosphoric acid. Thomas slag meals of different citrate solubility showed also different solubilities of their phosphoric acid in water saturated with carbon dioxid. Samples of high citrate solubility yielded the greater amounts of phosphoric acid by the carbon dioxid water method. After a certain number of extractions the solubility of the phosphoric acid in the different Thomas meals became uniform.

The amount of calcium not combined with phosphoric acid appeared to be about the same in the different samples tested. The content of the free lime was greater the smaller the citrate solubility, while the content of calcium silicate was greater with greater citrate solubility. It is thought that the varying citrate solubility is only in small part due to the variable content of free calcium. When the free calcium was separated out the solubility of the phosphoric acid by extraction with 2 per cent citric acid and with water saturated with carbon dioxid was increased but the differences in solubility still existed. These differences are attributed to the calcium phosphate itself, which it is thought may exist in a double compound of calcium phosphate and calcium silicate. Further experiments showed that in spite of the smaller differences in citrate solubility important differences in solubility as indicated by the first extraction with water saturated with carbon dioxid could enter.

The results are taken to indicate that the relations found between citrate solubility and solubility in carbon dioxid water do not yet show that the citrate solubility can be used to indicate the value of Thomas meal.

Results of geological investigation of phosphorite beds in Russia, 1913, IA. SAMOÏLOV (J. SAMOILOFF) (*Otchet Geol. Izsliedov. Fosfor. Zalezheĭ, 6* (*1914*), *pp. 1–29; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 12, pp. 1594, 1595*).—Investigations of the phosphorite beds of east and northeast European Russia, central European Russia, and central Asia are reported.

It was found that in the eight Provinces and regions the deposits cover an area of 1,840 square miles. "Adding this area to that discovered in the years 1908–1912, the total area becomes 4,510 square miles, containing not less than 3,300,000,000 tons of phosphorites, reckoning the yield at about 5 cwt. per square yard. These phosphorites may be divided into three groups according

to their phosphoric acid content. The first group, containing from 12 to 18 per cent of P_2O_5, represents 72.9 per cent of the whole; the second, with from 18 to 24 per cent represents 22.9 per cent; the third group, containing more than 24 per cent, represents only 4.2 per cent of the total. The total quantity of phosphoric acid in this mass of phosphorites exceeds 500,000,000 tons."

Phosphates and dolomites of Johnson County, Tennessee, O. P. Jenkins (*Resources Tenn., 6 (1916), No. 2, pp. 51–106, pl. 1, figs. 12*).—This report deals with the geology, mineralogy, and composition of the phosphate and dolomite deposits of the county and reports chemical analyses of samples. Some of the principal phosphate rocks contain over 60 per cent calcium phosphate.

"Chemically, calcium forms the base of the phosphate. Fluorin is present in amounts varying from about 1 to 1.5 per cent. Carbon dioxid is also present, in amounts varying from a fraction to nearly 3 per cent, and appears to vary pretty closely with the fluorin. Insoluble siliceous matter runs rather high, while iron and aluminum oxid are not much above the commercial limit, averaging about 5 or 6 per cent.

"The so-called limestones of Johnson County prove to be highly magnesian, and all those analyzed fall well into the class of dolomites, many of which are very high in content of calcium and magnesium carbonate. The dolomites, as well as some of the shales, are shown by analysis to contain from a trace to over 2 per cent lime phosphate. . . . The phosphate rocks occur in many pockets, scattered over the foothills of the main valleys, which lie near Mountain City. . . . It appears that the phosphate is generally too low grade to be of wide commercial use at present."

Experiments with lime and waste carbonate of lime, 1913 and 1914, A. Lauder, T. W. Fagan, and J. T. Steele (*Edinburgh: Edinb. and East of Scot. Col. Agr., 1915, pp. 10*).—Two years' experiments in three different localities with turnips on medium loam soil known to be affected with finger-and-toe disease, to determine the effect of quicklime and waste carbonate of lime when added with complete fertilization at the rates of 1, 2, 3, and 4 tons per acre, are reported.

The results obtained are taken to indicate "that a certain minimum amount of lime must be present in each soil. Beyond this point an increase in the amount of lime gives an increase in the effect. For the soils under experiment this limit may be placed at from 1 to 2 tons per acre. The results confirm those of work carried out elsewhere as to the beneficial effects of ground lime and carbonate of lime on land affected with finger-and-toe [disease]. When waste carbonate of lime is available it may be employed instead of ground lime for neutralizing soil acidity with satisfactory results. It should be applied at twice the rate of ground lime. For land which has not been limed for a considerable time, dressings of 2 tons of ground lime or 3 to 4 tons of the waste carbonate may profitably be given. When once the deficiency in lime in the soil has been made good, dressings of 10 cwt. to 1 ton per acre of ground lime should be applied at regular and frequent intervals, rather than heavy dressings at long intervals."

Effect of quicklime on organic matter in soils, F. E. Bear (*Jour. Amer. Soc. Agron., 8 (1916), No. 2, pp. 111–113*).—Experiments conducted at the West Virginia Experiment Station with a silt loam soil, used in fertilizer experiments at the station as noted by Bear (E. S. R., 35, p. 22), are reported.

The results show that "in every case the plat receiving quicklime, as compared with the plat receiving a corresponding fertilizer application without quicklime, shows a lower content of both nitrogen and carbon. . . . The results indicate that quicklime does reduce the amount of carbon and nitrogen in the soil."

Experiments with catalytic manures, I. GIANNOSI (*Italia Agr., 52 (1915), No. 10, pp. 455–458; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, p. 1596*).—Field experiments with hemp conducted at the Royal Agricultural College at Bologna, Italy, to determine the influence of catalytic fertilizers containing 7.32, 9.32, and 7.08 per cent of manganese tetroxid, when applied in amounts varying from 220 to 305 lbs. per acre, are reported.

The best yield was obtained on a control plat and the poorest on a plat receiving the catalytic manure, but the differences in the results from different plats were so small as to be within the limits of experimental error. It is concluded that the catalytic manure had no appreciable effect.

Composition of some oil cakes used as fertilizer in Tonkin [Indo China], BLOCH (*Bul. Écon. Indochine, n. ser., 18 (1915), No. 115, pp. 757, 758*).—Analyses of ten samples of oil cake are reported, showing contents of nitrogen varying from 1.02 to 4.76 per cent, potash in four cases varying from 0.042 to 0.3 per cent, and phosphoric acid in four cases varying from 0.203 to 1.955 per cent.

AGRICULTURAL BOTANY.

Starch congestion accompanying certain factors which retard plant growth, B. L. HARTWELL (*Rhode Island Sta. Bul. 165 (1916), pp. 23*).—It having been observed that accumulation of starch in potato vines followed a deficiency of available potassium in the soil, a series of investigations was undertaken to determine whether the deficiency of the element in question might inhibit cell development, causing less demand for starch, or whether potassium was essential as an activator of diastatic action.

As a result of the investigations it was found that an accumulation of starch seems to be correlated in general with conditions which cause a retardation of growth. The different factors which result in the accumulation of starch in the above-ground portion of the plant do not appear to interfere with photosynthesis, but it is thought that they may have some influence on subsequent metabolism.

Potato tuber production above ground, V. VILIKOVSKÝ (*Věstník 5. Sjez. Čes. Lék. Přír., 1915, p. 412; abs. in Bot. Centbl., 129 (1915), No. 15, p. 372*).—The author supports the view that the formation of tubers on the potato plant above ground is due to the excessive storing of starch. This is to be regarded as not necessarily pathological but as the result of producing starch faster than it can be removed to its more usual situation in the underground tubers.

The origin of anthocyanin pigments, A. GUILLIERMOND (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 19, pp. 567–570*).—The author discusses the two main hypotheses supported by different investigators regarding the origin of anthocyanin, the one being that anthocyanin pigments result from the transformation of colorless phenol compounds previously formed in the cells and the other that these pigments are formed in place directly as colored products. He agrees with the later views of Combes (E. S. R., 32, p. 824) in holding, as the result of his own investigations (E. S. R., 35, p. 333), that while anthocyanin is in a large number of cases found in the mitochondial body, it may under different circumstances be derived also from the transformation of colorless phenol compounds previously formed in the mitochondria and then dissolved in the vacuolar liquids.

Recent observations on pollen formation in certain monocotyledons, L. GUIGNARD (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 21, pp. 623–625*).—Reporting further observed exceptions to the two general modes of pollen formation (E. S. R., 34, p. 525), the author states that the Orchidaceæ may now be

added to the Iridaceæ, as a sufficient number of genera in the former family have been examined to create a strong presumption that the phenomenon of simultaneous quadripartition is general also for this family.

The ripening of seeds in legumes, C. Schneider (*Landw. Jahrb., 48* (*1915*), *No. 5, pp. 739–789, pl. 1, fig. 1*).—It is stated that during the process of ripening of legumes, before the green color has given place to yellow but not after that stage, there is a partial transformation of materials and transfer thereof to the seeds. This results in a gain of weight to the seeds at the expense of the other portions of the plant, the nonnitrogenous constituents preceding and the nitrogenous materials following. Backward plants show differences in this respect. Different legumes show characteristic ratios as regards their various constituents. While the readiness to germinate is developed early, the germination percentage is increased during the stage of yellowing, which should be completed before gathering the crop, as early harvesting checks the process of after-ripening and lowers the germination percentage.

Parallel tests of seeds by germination and by electrical response, Mary T. Fraser (*Ann. Bot.* [*London*], *30* (*1916*), *No. 117, pp. 181–189*).—These experiments, undertaken with a view to the further development of the electrical test used by Waller (E. S. R., 13, p. 461) on the germinability of seeds looking to its possible commercial application, are said to have yielded results which were quite consistent throughout the same samples of grain germinated under given conditions. It is stated that variations in electrical response of grains under varied conditions are strikingly paralleled by variations in the germination values. A certain amount of evidence has already been obtained that there is a time of maximal electrical response, probably corresponding to the time when growth becomes established. The electrical response can be ascertained in a much shorter time than the total germinative value. It appears to be possible also to discriminate on the basis of electrical response between live seeds of high and those of low vitality.

Relations between light and germination, G. Gassner (*Ztschr. Bot., 7* (*1915*), *No. 10, pp. 609–661, figs. 2*).—This is a series of preliminary studies including the latent influence of light on germination, the influence of desiccation, the relations between light and media favoring or hindering germination, the influence of light as related to seed bed temperature and after-ripening, the effects of previous treatments, the influence of chaff and of the semipermeable seed coat in the case of *Chloris ciliata*, and coloration of seed and of medium.

Studies in electroculture, R. Trnka, B. Mysík, and Š. Sajfert (*Věstník 5. Sjez. Čes. Lék. Přír., 1915, p. 408; abs. in Bot. Centbl., 129* (*1915*), *No. 17, p. 448*).—It is stated that while experimentation showed an increase of crops as a result of electrical influence, especially when employed during the hours of sunlight, it has not been sufficient to warrant its practical employment.

The influence of radio-activity on dissimilation processes, V. Zdobnický (*Věstník 5. Sjez. Čes. Lék. Přír., 1915, p. 431; abs. in Bot. Centbl., 129* (*1915*), *No. 15, p. 378*).—It is stated that while concentrated emanations from radio-active material injure living plants, very weak ones favor starch formation. The formation of sugar is said to be possible only when sunlight is added.

Are spore-forming bacteria of any significance in soil under normal conditions? H. J. Conn (*New York State Sta. Tech. Bul. 51* (*1916*), *pp. 3–9*).—The author states that the spore-forming bacteria, *Bacterium mycoides*, *B. cereus*, and *B. megatherium*, are nearly always present in soil and that they have been considered characteristic and important soil organisms. In nitrogenous culture media, these bacteria grow rapidly and cause a vigorous ammonification,

and for this reason they have been considered important ammonifiers of the soil. A series of tests was conducted to determine the significance of these organisms in the soil, 26 tests being made to ascertain their relative importance in heated and unheated soil infusions.

When the soil infusion was heated before plating to a temperature of from 75 to 85° C., nearly, if not quite, as many colonies of these bacteria developed as when plated from unheated infusions. This temperature is considered high enough to kill the vegetative forms of bacteria, and their constant occurrence in large number is believed to suggest that the bacteria are present in normal soils as spores rather than in the vegetative state. No increase in the total number of these organisms and no decrease in the number of their spores could be detected in soil to which fresh manure was added. These results are considered as casting doubt on the common assumption that these organisms are important ammonifiers in the soil and they raise a question as to what possible soil conditions favor their growth and multiplication.

A possible function of Actinomycetes in soil, H. J. Conn (*New York State Sta. Tech. Bul. 52 (1916), pp. 3–11*).—In the course of a qualitative study of the bacteria in certain New York State soils, there was recognized a great similarity between the different soils and the relative numbers of Actinomycetes and lower bacteria present, provided the soils were in the same state of cultivation. Later it was found that Actinomycetes were practically always present in greater abundance in old sod soil than in soil recently cultivated. An investigation of this subject has shown that the average ratio between the number of Actinomycetes in neighboring sod and cultivated spots of the same soil type is slightly more than 2:1. In a study of three neighboring spots in a single soil type, it was found that Actinomycetes colonies not only appeared in greater numbers from sod than from cultivated soil but also appeared in greater numbers from old sod than from sod only two or three years old. The reason for this difference in numbers has not been learned, but it is suggested that Actinomycetes are active in the decomposition of grass roots.

The number of colonies allowable on satisfactory agar plates, R. S. Breed and W. D. Dotterrer (*New York State Sta. Tech. Bul. 53 (1916), pp. 3–11*).—Attention is called to the importance in making bacteriological counts of the limit in the number of colonies that may be allowed to grow on a plate without introducing serious errors, and the authors present the results of an investigation testing the standard methods for bacterial milk analysis as adopted by the American Public Health Association and as modified in its meeting of 1915 (E. S. R., 35, p. 70).

The work reported includes a study of the counts made for a large number of agar plates incubated for five days at 21° C., and of some of the same plates after two days' additional incubation at 37°. The results obtained indicate that for milk analysis counts made from plates having more than 30 and less than 400 colonies are very nearly as satisfactory as those made from plates having more than 40 and less than 200 colonies.

A comparison between agar and gelatin as media for the plate method of counting bacteria, H. J. Conn and W. D. Dotterrer (*New York State Sta. Tech. Bul. 53 (1916), pp. 12–15*).—A comparison has been made between the counts obtained from 641 agar plates and 599 gelatin plates inoculated with various samples of soil, and the results show that the discrepant counts are as likely to occur with one medium as with the other. The remarkable agreement between the two media is believed to indicate that the nature of the medium used has little or no influence in producing the occasional widely discrepant counts which occur.

FIELD CROPS.

[Experiments with field crops], A. M. McOmie (*Arizona Sta. Rpt. 1915, pp. 518–528, figs. 4*).—Of 13 varieties planted as spring wheat, California Club produced the largest yield, 38 bu., and Turkey Red the lowest, 14.5 bu. per acre. Chul and Early Baart yielded each 36 bu. per acre and Blue Stem 35.3 bu. Red Chaff ranked first with 55 bu. per acre among 15 varieties sown the latter part of October, being followed by Blue Stem with 53.9, Turkey Red with 51. and Kofoid with 50 bu. per acre. In this list of varieties, Marquis produced 47.8, Early Baart 47.8, Red Fife 47.5, and Red Russian 47.3 bu. In every case fall-sown wheat outyielded the spring-sown and was also less subject to rust.

Sixty-day and Texas Red oats also gave better yields from fall than from spring planting. Black Eagar is described as a variety with black, oval, large, and heavy seed, an exceptionally long panicle, wide coarse leaves, and heavy, canelike stems, and as maturing readily at an elevation of 7,000 ft., where the growing season is very short.

Utah Winter, C. I. No. 592, produced the heaviest yield of 10 varieties of spring-sown barley, being followed by Mariout and Blue Hull-less. Black Winter emmer and spelt, both fall sown, yielded 3,630 and 2,970 lbs. per acre, respectively.

Of 25 varieties of corn under test, Sacaton Mexican June led in yield with 99 bu. per acre. Mexican White Flint and White Dent each yielded 85 bu., while some of the varieties fell as low as 10 bu.

The results of tests with Sudan grass showed that this crop is capable of maintaining 20 sheep per acre continuously for 100 days. In a comparison with Club Top, Sumac, and Amber cane for forage, Sudan grass gave a yield of 16,920 lbs. of dry hay and Club Top, the best of the other three varieties, 14,000 lbs. per acre. The leading grain-producing sorghums for the year were Shallu, Dwarf Black Hulled White Kafir corn, Yellow milo maize, and White milo maize.

Winter vetch gave a dry product of 13,400 lbs. and spring vetch of 16,750 lbs. per acre. A yield of 24 tons of sugar beets per acre is recorded for a planting made November 14, as compared with nearly 8 tons for a planting made February 9. The November plantings consistently exceeded the February plantings for the last four years. A yield of a little over 2,000 lbs. of sugar-beet seed is reported. Twelve varieties of flax ranged in yield from 83.5 to 36.5 bu. per acre. The leading variety of millet was Kursk.

The best success with winter grains of any so far experienced at the Snowflake dry farm was obtained the past year, the yields ranging from 12 to 32 bu. per acre, with Turkey Red and Marquis leading in production. A yield of about 1,100 lbs. of seed per acre was secured from the Tepary bean, while Pink and Boetcher also gave good yields.

At the Sulphur Spring Valley dry farm October seeding of small grains gave better yields than later seeding. Marquis wheat produced the largest yield, 19.8 bu. per acre, while Turkey Red, Red Chaff, Early Baart, and California Club also proved satisfactory. Barley and rye were found valuable as winter pasture crops, and both produced grains after being pastured. Spring varieties of grain seeded March 15 practically failed. Notes are given on the production of crops on shallow soil underlaid with caliche and on deep soils with clay and a porous or soft caliche subsoil.

The crops succeeding best at this farm during the past two years were Kafir corn, Shallu, Club Top, and other saccharin sorghums; Whippoorwill cowpeas; Sudan grass; and Mexican June, White Wonder, Sherrod, Freid, White Flint,

and Diamond Joe corn. These crops succeeded best when planted from April 1 to May 15.

Notes are given on the production of beans, corn, wheat, emmer, and potatoes at the Prescott dry farm. The leading varieties of beans were Colorado Pinto, Bates, Boetcher, and Tepary, mentioned in decreasing order of yield. Sudan grass produced 3.5 tons of dry hay per acre from two cuttings, in addition to a pasture crop. On bottom land a yield of 3 tons was secured from the first cutting and 2⅝ tons from the second, but there was no pasture crop. These plats were planted in rows 42 in. apart. Sudan grass sown with a grain drill failed to reach a height sufficient for cutting. A yield of 3 tons per acre of this grass is also recorded for the high plateau sections, where it was grown at an elevation of about 7,000 ft.

[Breeding work with field crops], G. F. FREEMAN and J. C. T. UPHOF (*Arizona Sta. Rpt. 1915, pp. 533–538, fig. 1*).—In variety tests with alfalfa at Yuma the hairy type of Peruvian gave the best yields. From the cutting made March 23, 1915, this type of alfalfa produced 5,500 lbs. of hay per acre as compared with 4,738 lbs., the average of the other varieties in the test. The corresponding figures for the cutting made December 8, 1915, were 2,217 and 1,701 lbs., respectively.

An average yield per acre of 1,810 lbs. of green beans was secured from 17 pure races of Tepary beans grown at the Yuma date orchard, the highest yield being 2,526 lbs. for race No. 48. Fifteen lbs. of wild Tepary seed was planted in field plats at Yuma for comparison with the domesticated form as a hay crop. On one plat this seed yielded at the rate of 5,080 lbs. of air-dry hay per acre and on another at the rate of 6,180 lbs. In this test pure race No. 17 yielded 9,760, 6,795, and 5,882 lbs. and Whippoorwill cowpeas 5,960 lbs. per acre of air-dry hay.

A yield of cleaned wheat of 42.91 bu. per acre was secured at this point. As compared with the yield in 1914 this was an increase of 5.24 bu. per acre, which is thought probably due to turning under a few weeks before seeding the wheat in the fall a green manure crop of Tepary beans yielding approximately 15,000 lbs. of green material per acre. In a test of varieties Turkey Red yielded at the rate of 57 bu. per acre, but the averages for all the field plats were as follows: Sonora 51.7, White Algerian Macaroni 44.6, Red Algerian Macaroni 44.6, Early Baart 43.3, and Turkey Red 43.2 bu. per acre.

Among 63 pedigree increase plats from the selection of the best head rows of the preceding year the White Algerian Macaroni strains gave an average of 11.4 bu. per acre more than the average for the other strains. It was observed in connection with this work that certain strains of Turkey wheat, all of which were hard when grown in the Central Plains States, immediately became soft when grown in Arizona under irrigation, while other strains from the same original sources have remained hard. It was also found that on the average those strains becoming soft immediately were greater yielders than those which resisted the softening effect of the climate, but a few pure races of hard Turkey wheat were found which were high yielders and at the same time maintained their hard, glutenous texture.

Report of the agronomy department, C. A. SAHR (*Hawaii Sta. Rpt. 1915, pp. 39–44, pls. 2*).—Deep plowing of soil and allowing it to aerate from one to several months before planting rice and taro gave increased yields in every test, although in the case of taro the increase was small. Potatoes on soil with 16 per cent of water in the upper 6 in. failed to sprout properly, while soil with 24 per cent of moisture produced plants. In a spraying test the check plat yielded 15 bu., the plat sprayed with lime-sulphur 25.9 bu., and the one sprayed with Bordeaux mixture 30.2 bu. of tubers per acre.

Notes are given on culture tests with clover, sweet clover, *Crotalaria mesopontica, C. madurensis, C. incana, C. striata, Stizolobium hassjoo, S. cinereum,* and *S. capitatum.* Jack beans and species of velvet beans sown early in September gave the best yields of both green substance and seed. The following annual yields of green forage from different varieties of alfalfa are reported: Spanish 56,362 lbs., Kansas common 52,065 lbs., Utah common 45,245 lbs., Peruvian 35,530 lbs., and Turkestan 30,595 lbs. per acre. Semipalatinsk alfalfa (*Medicago falcata*) did not prove equal to common alfalfa or Japan clover (*Lespedeza striata*).

The total yields of green forage per acre for a period of 26.5 months for the sorghums and 27 months for the Japanese cane are recorded as follows: Sweet sorghum, 8 cuttings, 86.55 tons; nonsaccharin sorghum, 6 cuttings, 88.45 tons; and Japanese cane, 3 cuttings, 157.64 tons per acre. The results with other varieties of sorghum are also noted.

Of the several forage grasses on trial, Sudan grass retained its lead in the production of green forage, yielding at a low elevation an average of 14.5 tons per cutting per acre for 7 cuttings as compared with an average of a little less than 4 tons per acre for 6 cuttings for Tunis grass. The value of other grasses, including molasses, Wilder, Australian blue, Giant Bermuda, teff, Mitchell, wallaby, side oat grama, Judd, and American buffalo grass, is briefly mentioned. Japanese millet is reported as maturing at the station in 80 to 100 days under ordinary conditions and as yielding about 10 tons of forage per acre when cut green and 3 tons of roughage and 30 bu. of seed per acre when left to mature. The best results in controlling the spread of Japanese nut grass were secured by spraying with arsenite of soda.

Japanese buckwheat was found to mature a week earlier than Silverhull and to yield about 25 per cent more grain. The average annual yield per tree for 4 years of Caravonica cotton planted on the station grounds in February, 1910, was approximately 1 lb. of lint. The distribution of seed of cotton and grasses conducted by the department is briefly mentioned.

[Work with field crops in 1915] (*Wisconsin Sta. Bul. 268 (1916), pp. 4–6, 10–15, 32, 36, figs. 10*).—In connection with the work of the agronomy department with pedigreed strains of rye, an improved strain known as Pedigree No. 1, and excelling in stiffness of straw and milling qualities, was developed from the Schlansted variety. A yield of 46.5 bu. per acre under field trials, or 14.5 bu. over the yield of common varieties, is recorded. A cross by E. J. Delwiche between Minnesota 169 and Red Fife wheat produced a strain with exceptional stooling power, marked resistance to rust, a strong straw, and early maturing qualities. In 30 tests at the station by R. A. Moore and B. D. Leith with wheat, Pedigree No. 2, a type of Turkey Red winter wheat, yielded 49.6 bu. per acre and Marquis spring wheat 43 bu. Milling and baking tests with 21 samples of the 1914 crop showed that Pedigree No. 2 gave fully as good results as the standard spring wheats of highest milling quality. The Wisconsin spring wheats analyzed 12.46 per cent of gluten as compared with 11.05 in the standard spring wheat patent flours.

The work of the station to establish hemp growing in the State, conducted by C. P. Norgord, is described and the progress made in this direction is noted. The results of comparative trials of over 200 strains and varieties of alfalfa by L. F. Graber indicated that the common purple-flowered alfalfa from Kansas and Nebraska seed withstood winterkilling last winter quite as well as alfalfa from northern-grown seed. Pedigree No. 4 and White Jewel oats grown in the Superior district were found by E. J. Delwiche to be the most resistant to the influences causing lodging. Yields of 2.5 to 3.7 tons of hay per acre are reported

as secured in plat tests although the season was unfavorable on account of prevailing low temperatures.

Studies made of the influence of freshly turned under green manures like clover on the germination of seeds rich in oil indicated that germination is injuriously affected by a soil fungus, Rhizoctonia, which is given most favorable conditions of growth through the incorporation of organic matter.

Investigations on the relation of sulphur to plant nutrition were extended to oats and barley which were materially helped, especially in seed production, by an increased supply of sulphates, but the effect was not so marked as with rape and clover. The influence of elemental sulphur, while sometimes beneficial, was found often to exert a poisonous effect.

Relative water requirement of corn and the sorghums, E. C. Miller (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 13, pp. 473–484, pls. 3, fig. 1*).—In work carried on by the Kansas Experiment Station, the water requirement was determined for four varieties of corn and two varieties of sorghum in 1914, and for three varieties of corn and five varieties of sorghum in 1915. The work was carried on at Garden City, Kans., where the plants were grown in large, sealed, galvanized-iron cans containing approximately 110 kg. of soil, having a wilting coefficient of 13 and a moisture content maintained at from 20 to 21 per cent on the dry basis. Three plants of corn were grown in each can during both seasons, and 6 sorghum plants were grown in each can in 1914, but only 3 in 1915. A summary of the data secured in the experiments, which are tabulated in detail, shows the following relative standing as to water requirement of the different crops and varieties for the two years: In 1914, Blackhull Kafir corn 1, Dwarf Milo maize 1.04, hybrid corn 1.09, Sherrods White Dent corn 1.22, and Pride of Saline corn 1.24; in 1915, Blackhull Kafir corn 1, Dwarf Blackhull Kafir corn 1.02, Dwarf Milo maize 1.12, feterita 1.14, hybrid corn 1.17, Pride of Saline 1.23, Sherrods White Dent corn 1.27, and Sudan grass 1.41.

Sorghum and millet, F. A. Welton (*Mo. Bul. Ohio Sta., 1 (1916), No. 6, pp. 168–174, figs. 2*).—This article discusses briefly the culture and value of sorghum and millet, and reports the yields secured in comparative tests with these crops.

A comparison of corn and sorghum during the four years beginning with 1912 showed that such late varieties of corn as Blue Ridge, Hickory King, and Boone County White produced larger yields of green forage per acre than were obtained from sorghum, while two early varieties, Darke County Mammoth and Leaming, yielded less than sorghum. For the same period average yields of 10, 14, 9.1, 9.9, and 7.6 tons of green forage per acre are reported for Amber sorghum, Orange sorghum, Red Kafir corn, White Kafir corn, and Yellow milo maize, respectively. The average production for seven nonconsecutive years of Hungarian, German, Red Siberian, and Japan barnyard millet tested on the station farm was 2.6, 4.4, 2.8, and 4.8 tons of dry forage per acre, respectively.

Concerning the growth and composition of clover and sorrel (Rumex acetosella) as influenced by varied amounts of limestone, J. W. White (*Pennsylvania Sta. Rpt. 1914, pp. 46–64, pls. 13*).—Studies on the general fertilizer plats of the station, supplemented by pot experiments, were made with reference to the growth of sorrel as influenced by soil acidity. Work related to this subject by other investigators is briefly reviewed and the results presented in tabular form are discussed. Some of the plats on which the investigation was conducted received ammonium sulphate as the source of nitrogen and showed an increasing tendency to failure of clover and to a less extent of corn and wheat.

In 1912–13 sorrel grew on plat 32 having an acid soil at the rate of 1 ton per acre. In areas where the soil acidity required from 3,500 to 3,800 lbs. of

calcium carbonate per acre to correct it to the depth of 7 in., clover failed and sorrel took its place; where from 4,000 to 4,500 lbs. of calcium carbonate were similarly required, timothy was largely replaced by sorrel; and where the maximum acidity was reached red top predominated. Plats receiving calcium as sulphate and carbonate are reported as free from sorrel.

In the pot experiments the greatest yield of clover occurred where limestone was applied at the rate of 3 tons per acre in excess of the quantity required to render the soil neutral. Clover failed in these tests where the acidity for its correction required from 3,000 to 3,500 lbs. of calcium carbonate per acre for the upper 7 in. of soil. Where limestone was present in slight excess in the pot experiments, sorrel was largely replaced by clover, but it produced the highest yield where the maximum amount of limestone was applied.

The calcium content of clover and sorrel was highest where the largest quantity of limestone was added to the soil. The protein content of clover was found to vary but slightly whether grown in an alkaline or an acid soil. The calcium content of sorrel grown on plat 32 was determined as only 10 per cent of that grown in an alkaline soil. The leaves of sorrel grown on this plat contained 17.92 per cent protein, equivalent in amount to that in clover, and the sorrel contained per ton of dry matter the equivalent of $9.03 in nitrogen, potassium, and phosphorus as compared with the corresponding value of $10.97 for clover. The water-soluble acidity of the sorrel from this plat calculated to oxalic acid was found to be as follows: Total plant 1.36 per cent, leaves 2.45 per cent, stem 0.969 per cent, and seed 0.44 per cent, as compared with 0.98 per cent in the whole plant grown on alkaline soil.

On the basis of these results the author concludes that sorrel is not an acid-loving plant but has the property of adaptation under soil conditions unfavorable to the growth of most field crops.

Winter injury of alfalfa and clover, C. A. GEARHART (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 199–201*).—Data collected in 64 per cent of the counties of the State are reported as showing that 22.7 per cent of the red clover, 22.3 per cent of the mammoh clover, 17.3 per cent of the alsike clover, and 44 per cent of the alfalfa winterkilled during the winter of 1915–16. Grimm alfalfa was found to show no greater resistance to winter conditions than common alfalfa from seed produced in the Northwestern States.

Comparative yields of hay from several varieties and strains of alfalfa at Brookings, Highmore, Cottonwood, and Eureka, A. N. HUME and M. CHAMPLIN (*South Dakota Sta. Bul. 163 (1916), pp. 282–343, figs. 9*).—Historical and descriptive notes are given of a number of varieties and strains of alfalfa and other species of Medicago introduced and tested in South Dakota. Results are reported of comparative trials of several varieties and strains of alfalfa made at Brookings, Highmore, Cottonwood, and Eureka.

The average yield of field-cured hay per acre in the four localities for the three years, 1913 to 1915, was 2,565 lbs. for Vale, 2,532 lbs. for Grimm, and 2,527 lbs. for Turkestan alfalfa. It is not implied that these three strains should be produced to the exclusion of all others, but it is advised that such strains as Baltic S. D. No. 167, Common S. D. No. 12, Kansas Nonirrigated S. D. No. 173, and other strains now successfully grown in the State should not be hastily discarded. Attention is called to the fact that although Turkestan alfalfa is adapted to hay production in South Dakota, the seed of the variety has a much more limited market outside of the State than the seed of other strains. Field trials of strains of *Medicago falcata* made at Brookings are reported as indicating that the species may not yield as large average amounts of hay as the strains of *M. sativa* which have been tested.

Correlated characters in maize breeding, G. N. COLLINS (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 12, pp. 435–454, pls. 9*).—This article reports the results of a study undertaken "to determine whether the difficulty in recognizing types of maize is due to a lack of familiarity with the plants or whether there is a fundamental difference between the heredity of maize and that, for example, of cotton." It was thought that the difficulty of recognizing types among maize plants might be due to a lack of sufficient discrimination and that correlations were the rule rather than the exception. The data obtained were afforded by a cross between Waxy Chinese and Esperanza, Chinese and Mexican varieties respectively, with a number of definitely contrasted characters and considered completely isolated from very remote times. Tables are given showing the mean of different characters and the coefficient of variation of characters in first and second generation plants, correlation coefficients, and character pairs exhibiting genetic correlations. The following characters are discussed: Hairs on the leaf sheath, tassel characters, tassel exsert, number of erect leaf blades, angle of tassel axis, and one-sidedness or the peculiarity that a number of the upper leaf blades are borne on one side of the plant.

The results are reported as showing that the characters studied, instead of forming coherent groups, are almost completely independent in inheritance. For the purpose of distinguishing different kinds of correlations they are classified as physical, physiological, and genetic, and a method is proposed by which physiological and genetic correlations may be distinguished.

For the study of correlations 11 of the characters most definitely contrasted in the parents were selected and the correlation coefficients of all the combinations were calculated. Of the 55 possible combinations, 20 were found to exhibit significant correlations, but in all but 5 of these correlations are believed to be physiological rather than genetic. No correlation was found between any two characters closer than 0.5, which fact is regarded as offering an explanation of the difficulty of recognizing types in maize.

"This lack of coherence of characters in maize, taken with the fact that to maintain a satisfactory degree of vigor a diversified ancestry must be maintained, would appear to make the method of isolating types inapplicable to this plant. As an offset to the limitation thus imposed, advantage may be taken of the facility with which desirable characters derived from different parents can be combined."

Cooperative fertilizer experiments with corn, 1908–1914, G. S. FRAPS (*Texas Sta. Bul. 184 (1916), pp. 3–64*).—The results secured during the first three years have been previously reported (E. S. R., 25, p. 627). This bulletin deals mainly with the experiments carried on from 1911 to 1914. Tables are given showing the results secured by the different cooperators and the composition of the soils on which the tests were made. The details of each test are briefly noted and the effect of the different fertilizers or fertilizer ingredients is discussed.

During the seven years, 114 experiments were made and in 87 of this number a gain was secured from acid phosphate, in 76 from cotton-seed meal, and in 46 from potash. It is concluded from the data that the soils concerned need phosphoric acid first, nitrogen next, and potash least. Using from 150 to 200 lbs. of acid phosphate the average gain produced was from 5 to 7 bu. of corn per acre. From 30 to 100 lbs of cotton-seed meal, there was an average gain of 0.4 to 3.8 bu., when used in combination with acid phosphate, while with 200 lbs. of cotton-seed meal, alone or with acid phosphate, there was from 5.5 to 7.1 bu. increase, the results being based on only those experiments in which a gain occurred. From 5 to 25 lbs. of muriate of potash per acre, there were produced

average gains of from 2.3 to 3.2 bu. of corn, and with 50 lbs. of muriate of potash, from 2.1 to 5.1 bu. The average gain ascribed to barnyard manure was from 8.3 to 11.5 bu. per acre, or larger than the gains from acid phosphate, cotton-seed meal, or potash salt.

Thomas phosphate used in 12 tests had about 60 per cent of the effectiveness of acid phosphate. In 11 experiments the phosphoric acid of rock phosphate showed about 22 per cent of the effect of the phosphoric acid of acid phosphate. With lime, used in 12 experiments, there was an average gain of 4.5 bu., but no gain in one-half of the tests. When 50 lbs. of nitrate of soda was substituted for 100 lbs. of cotton-seed meal in 49 experiments, the average difference in favor of cotton-seed meal was about 1 bu. of corn per acre. Manure gave profitable results in the greatest number of tests. Acid phosphate alone gave a large number of profitable increases, and cotton-seed meal alone gave nearly the same number. Cotton-seed meal with acid phosphate gave profitable results in 42 per cent of the trials.

Tests of soy beans, 1915, E. H. Jenkins, J. P. Street, and C. D. Hubbell (*Connecticut State Sta. Bul. 191 (1916), pp. 14, fig. 1*).—This bulletin presents the data gathered in 1915 in continuation of earlier work (E. S. R., 32, p. 633).

Twenty unnamed varieties of soy beans, chiefly new introductions grown in cooperation with the U. S. Department of Agriculture, ranged from 97 to over 150 days in period of growth and from 19.3 to 31.2 bu. of seed per acre in yield. The named varieties tested required from 6 to 15 days longer to mature, produced on the average 1,200 lbs. less of dry forage per acre, and the dry feed contained about 1.1 per cent more protein, as compared with the results of the same varieties in 1914.

The range in yield per acre of 18 varieties grown in 1915 was from 5,672 to 22,477 lbs. of green forage and from 12.5 to 29 bu. of seed. The results of two years' tests of those varieties which grew successfully in both years are reported as indicating that Wilson, Ebony, and Cloud, small, black-seeded varieties, were in both years among the six varieties yielding the most dry matter in the green forage. Tables are given showing the yield and composition of soy-bean forage, alfalfa, and ensilage corn as determined at the station, and the nutrients per ton of ensilge corn, soy-bean forage, and mixtures of the two. It is stated that an average crop of soy beans such as was grown by the station the past two years contains, exclusive of the roots, approximately 4,255 lbs. of organic matter, 131 lbs. of nitrogen, 23 lbs. of phosphoric acid, and 93 lbs. of potash per acre.

Results of field tests by farmers are briefly noted, and an outline is given of a paper on soy beans as a food for diabetics, previously noted (E. S. R., 34, p. 311).

Tobacco experiments, 1913, W. Frear, O. Olson, and H. R. Kraybill (*Pennsylvania Sta. Rpt. 1914 pp. 347–374, pls. 12*).—The experiments here described were conducted in cooperation with the U. S. Department of Agriculture and with tobacco growers' societies in Lancaster, Clinton, and York counties in the State. Experiments in Lancaster County were conducted to determine the most productive strain of the Connecticut Seedleaf or Broadleaf variety. The collection of strains by elimination based on earlier results was reduced to 10 in number. The object of the work in Clinton County was the determination of the type of tobacco best adapted to the soil and climate of the Clinton-Lycoming tobacco region. The experiments in York County were inaugurated during the year to ascertain the cause of the decrease in burning quality of the tobacco grown. Earlier and similar work with tobacco has been previously noted (E. S. R., 34, p. 142). Meteorological data and notes on crop conditions, together with results bearing on yield, plant measurement, and leaf quality, are presented in tables.

In the strain selection work with Connecticut Seedleaf or Broadleaf tobacco in Lancaster County, the yields of the different filler strains were as follows: Slaughter, F 1, 1,910 lbs., Cooper, R 1, 1,910 lbs., Espenshade, N 1, 1,795 lbs.. "Weaver," B 100, 1,738 lbs., Hershey, K 1, 1,719 lbs., Hostetter, D 1, 1,700 lbs., Ober, J 1, 1,643 lbs., Hoover, A 200, 1,624 lbs., Pound, H 100, 1,604 lbs., and Burkholder, A 300, 1,413 lbs. per acre. The results of plant measurements showed that the leaf dimensions presented no close relationship between the leaf expanse and the relative weights of the cured topped plants.

In an experiment on planting distance and topping height for cigar tobacco, plants were placed 28 in. apart in the row in rows 42 in. apart, and 28 in. apart in the row in rows 36 in. apart. The plants were topped at 15 to 17 or 18 leaves for high topping and at 11 to 14 leaves for low topping. Cultivation was continued in each case beyond the stage of leaf spread when it is usually discontinued in practice. In considering the results of the three previous years with those of 1913, it appeared that in all seasons high topping resulted in the highest gross yield, in two seasons high topping and close planting gave a distinctly greater yield, while in the other two seasons the wider planting gave a slightly higher return. Low topping and close planting led to distinctly higher yields in three out of the four seasons. The close planted tobacco in 1913 produced 10.6 per cent of seconds as compared with 8.6 per cent for the wider or normal planting. Of the normal planted tobacco 75 per cent by weight of the leaves were from 22 to 26 in. in length, and of the close planted tobacco only 66 per cent. The high topped plants showed 69 per cent by weight of long leaves known as firsts, and the low topped, 73 per cent. The results for similar spacing and topping tests made in 1913 on a sandy, loam soil in Clinton County are tabulated without conclusions.

Fertilizer experiments were conducted with the Slaughter strain of seedleaf tobacco. Two plats were fertilized with manure alone at the rate of 10 tons per acre, and two with the same application of manure supplemented with acid phosphate and sulphate of potash at the rate of 300 lbs. and 100 lbs. per acre, respectively, in addition. The average yield of the plats treated with manure, acid phosphate, and sulphate of potash was 1,955 lbs. per acre, and the average yield for the plats treated with manure alone, 1,655 lbs.

Several different types of tobacco were grown for a number of years to study the effect of environmental conditions in Lancaster County on their characteristics. The results are reported as showing that the various strains retained their characteristic points of distinction.

Tests in Clinton County on different farms with wrapper and binder strains in 1913 resulted in the following yields: Local Havana 1,605 lbs., Wisconsin Havana 1,497 lbs., Connecticut Broadleaf 1,477 lbs., Local Havana 1,410 lbs., Local Havana 1,395 lbs., Local Havana 1,347 lbs., Connecticut Havana 1,260 lbs., and Local Havana 1,200 lbs. per acre. In tests with other wrapper varieties it was found that seed from shade-grown Cuban planted in the open produced leaves too short and heavy for wrapper purposes. The yields secured in this test were as follows: Halliday Havana, primed, 1,912 lbs., Halliday Havana, cut, 1,425 lbs., Connecticut Havana 1,294 lbs., and Shade-grown Cuban (seed from Connecticut) 750 lbs. per acre.

The influence of suckering upon the yield and quality of tobacco, H. R. Kraybill (*Pennsylvania Sta. Rpt. 1914, pp. 374, 375*).—An experiment was made on two plats to demonstrate the value of suckering tobacco. A difference of 330 lbs. of cured leaf per acre in favor of the suckered plants was secured with a difference in quality in favor of suckering even greater than the difference in yield.

Influence of time of topping upon distance between leaves on the stalk, H. R. Kraybill (*Pennsylvania Sta. Rpt. 1914, pp. 375–377*).—Observations were made in 1913 upon 64 plants of the Slaughter strain of Pennsylvania Broadleaf similar in size, uniformity, and vigor. Sixteen plants were topped as soon as the first bud was visible, 16 at the stage of development half-way between the time when the first bud had appeared and the time when the first blossom appeared, 16 when the first flower appeared, and 16 were allowed to mature seed. All topped plants were topped to 15 good leaves.

The data presented in tables indicate that the stem continues to elongate even after the first flower appears but that the portion bearing the eighth to the fifteenth leaf makes the greater increase in length. From the time the first bud appeared both portions of the stem seemed to elongate, the portion bearing the first to the eighth leaf making the slightly larger increase. Topping appeared to arrest growth, affecting to the greatest extent the portion bearing the eighth to the fifteenth leaf. A distinct increase in the length of the internodes was observed after the time the first bud appeared, the average increase between neighboring leaves of the first to the eighth leaf being 0.183 in. or 20.8 per cent, and of the eighth to the fifteenth leaf 0.13 in. or 10.4 per cent.

White Burley tobacco, I. S. Cook and C. H. Scherffius (*West Virginia Sta. Bul. 152 (1916), pp. 3–20, figs. 6*).—Cultural directions, including soil selection and preparation, rotations, transplanting, cultivation, topping, selection of seed plants, harvesting, curing, stripping, and grading are given, and the results of variety and fertilizer tests are reported. The work is in cooperation with the U. S. Department of Agriculture.

Introduced varieties of White Curley grown from selected seed gave promise of proving superior to the standard variety grown in the State. The results of several fertilizer tests indicated that nitrogen influences the yields of tobacco in the State more than does either potash or phosphoric acid. A combination of all three plant food constituents produced the highest average yield, and an application of about 700 lbs. of a high-grade fertilizer containing not less than 4 per cent of nitrogen was found profitable. In one test conducted for two years the use of 10 tons of barnyard manure per acre gave the best results of all fertilizer materials applied. The approximate cost of growing an acre of tobacco, including the use of 1 ton of ground limestone, 200 lbs. each of sodium nitrate and potassium sulphate, and 300 lbs. of acid phosphate was determined as itemized at $66.50.

Tobacco growing in Canada, F. Charlan (*Canada Dept. Agr. Bul. 25, 2. ser., pp. 29, figs. 8*).—This bulletin discusses in a popular manner the different phases of tobacco culture, such as the selection and preparation of the soil, the use of hotbeds, cultural methods, harvesting, curing, fermentation, and marketing.

Wheat experiments, C. G. Williams (*Ohio Sta. Bul. 298 (1916), pp. 447–484, figs. 19*).—This bulletin reports the results of experiments with wheat covering the period from 1887 to 1915, most of the work having been done the last 15 years. The experiments included soil treatment, methods of seeding, tests of varieties, variety improvement by means of pure line selection, and milling and baking tests. Most of the work was done on the station farm at Wooster, but results secured at Columbus, at the district experiment farms at Strongsville, Germantown, Carpenter, and Findlay, and at the county experiment farms in Paulding, Miami, Hamilton, and Clermont counties are also reported.

Wheat without fertilizer treatment in a 5-year rotation with corn, oats, clover, and timothy averaged 42 per cent higher in yield, and in a 3-year rotation with corn and potatoes 50 per cent higher than wheat receiving no fertilizers in

continuous culture. As compared with corn, wheat declined less in yield when grown continuously without fertilizers, and as compared with corn and potatoes in 3-year rotations without fertilizers showed greater hardiness and persistence.

In fertilizer experiments 14 per cent acid phosphate was used at the rate of 160 lbs. per acre on wheat and 320 lbs. per rotation at Wooster and Strongsville and of 120 lbs. on wheat and 240 lbs. per rotation at Germantown and Carpenter. Muriate of potash was applied at the rate of 100 lbs. per acre on wheat and 260 lbs. per rotation at Wooster and Strongsville and 20 lbs. per acre on wheat and 40 lbs. per rotation at Germantown and Carpenter. Nitrate of soda and dried blood were given at the rate of 120 lbs. and 50 lbs. per acre, respectively, on wheat, an equivalent of 480 lbs. of nitrate of soda per rotation at Wooster and Strongsville and at the rate of 80 lbs. on wheat and 160 lbs. per rotation at Germantown and Carpenter. Barnyard manure was applied at the rate of 4 tons per acre on wheat and of 8 tons per rotation at Wooster and Strongsville and of 5 tons per acre at Germantown and Carpenter. In arriving at the financial results, corn was valued at 50 cts. per bu., oats at 33⅓ cts., wheat at 90 cts., hay at $10 per ton, corn stover at $4, and straw at $2. The acid phosphate was valued at $14 per ton, muriate of potash at $50, and nitrate of soda at $60. The extra cost of harvesting the increase of crops was placed at 10 cts. per bu. for cereals and $1 per ton for hay. In the fertilizer tests at Wooster, Strongsville, Germantown, and Carpenter the use of phosphorus alone increased the yield of wheat from 4.85 to 8 bu. per acre, phosphorus and potassium from 6.2 to 9.19 bu., and phosphorus, potassium, and nitrogen from 8.77 to 16.2 bu. Based on all the crops of the rotation and taking into account the fertilizer cost and the expense of harvesting the increase, the average annual net value per acre of the increase from the use of phosphorus at the four points was $2.87, from phosphorus and potassium, $3.21; and from phosphorus, potassium, and nitrogen, $2.60. The cost of the nitrogen in commercial forms did not justify its use in the growing of cereals. In these experiments manure gave a return of more than $3 per ton without proper reinforcement with phosphorus, while in other experiments at the station a return of more than $4 per ton has been secured.

The use of 1 ton of burnt lime or 2 tons of ground limestone per acre once in five years on the acid soil at Wooster increased the yield of wheat 2.11 bu. per acre as a 10-year average. The lime increased the value of all crops in rotation from $6.17 to $27.41 per acre, depending upon the fertilizer treatment. The average gain for lime per rotation was $16.47 per acre. No treatment of the soil with fertilizers or manure rendered lime unnecessary.

Plowing 15 in. deep showed a gain of 0.43 bu. per acre over plowing 7.5 in. deep, and ordinary plowing with subsoiling showed a gain of 1.04 bu. of wheat over ordinary plowing alone. Neither deep plowing nor subsoiling proved profitable on the Wooster silt loam soil.

The results from broadcasting and drilling seed varied widely with the season. As an average of five seasons the gain for drilling was 3.8 bu. per acre. No difference in yield was found between drilling 1 in. and 2 in. deep, and a 3-in. depth showed but a slight decline. As an average of three tests with the same quantity of seed per acre, cross-drilling gave an average gain of 0.76 bu. of wheat per acre over drilling one way.

The results of making nine different seedings of wheat at intervals of one week, beginning September 1 and ending October 26, for a period of 14 years, were in favor of the seedings made September 21 and 22, with the seedings on September 28 and 29 standing next, and those of September 14 and 15 third. The results of experiments on the use of from 3 to 10 pk. of seed per acre and

extending over a period of 17 years with 10 different varieties showed that 8 pk. per acre proved most profitable, the use of 9 pk. standing second, and of 6 pk. third.

No important differences in yield were found in comparing heavy kernels of seed wheat with light kernels with such variations in weight as can be secured with the ordinary fanning mill. With hand-selected seed of pure line strains with variations in weight of 100 per cent or more, important increases in yield were obtained from the heavy kernels.

Of the varieties tested for 18 years the following, mentioned in decreasing order of yield, gave the best results: Dawson Golden Chaff, Nigger, Poole, Gipsy, Valley, Harvest King, Mealy, Gold Coin, Hickman, and Nixon. Dawson Golden Chaff, Mealy, and Gold Coin are reported as of inferior milling and baking quality. Variety tests conducted the last eight years and including five of the newer varieties not in the trial above mentioned showed Portage, Dawson Golden Chaff, Gold Coin, Gladden, Trumbull, Early Red Clawson, Harvest King, Red Wave, Hickman, and Poole, given in decreasing order, to have been the highest yielders. New varieties recommended to be seeded at the rate of 1 pk. per acre were found to require as heavy seeding as the old standard varieties.

In following the pure line method of selection decided differences in winter resistance, stiffness of straw, yield of grain, and breadmaking qualities are reported to have been found in the progeny of individual heads selected from ordinary varieties of wheat.

Some lessons from the wheat crop of 1915, C. E. Thorne (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 215–217*).—Land growing wheat continuously without fertilization since 1894 yielded 10 bu. per acre in 1915, this being the largest yield in 12 years. The average production without fertilizers for the 22 years was raised to 7.5 bu. per acre. An annual dressing of 5 tons of barnyard manure per acre increased the yield to 23.8 bu. for 1915, and to 18 bu. for the 22 years, and 430 lbs. of complete fertilizer raised the yields to 22.6 bu. and 19.3 bu., respectively.

Wheat without fertilizer treatment grown in a 3-year rotation with corn and clover since 1898 yielded 17.3 bu. in 1915, and an average of 11.9 bu. for the 18 years. Where only the corn in this 3-year rotation received 8 tons of barnyard manure per acre, the yield of wheat in 1915 was 24 bu., the 18-year average being 20.7 bu. Manure applied at this rate but dusted with 40 lbs. of acid phosphate per ton gave a yield of 29.8 bu. per acre in 1915 and an average of 26.6 bu. for the 18 years.

In another 3-year rotation including clover and begun in 1894, wheat followed potatoes. In this test the unfertilized wheat yielded 33.7 bu. per acre in 1915, and averaged 26 bu. for the 21 years. Where both potatoes and wheat received 160 lbs. of acid phosphate on each crop, the wheat yield rose to 39 bu. in 1915 with an average of 35.4 bu. for the entire period. The addition to the acid phosphate of 100 lbs. of muriate of potash each for potatoes and wheat increased the yield to 40.7 bu. in 1915 and to 35.6 bu. for the entire period. A further addition of nitrate of soda, 80 lbs. per acre on potatoes and 160 lbs. on wheat, raised the wheat yield for 1915 to 43.2 bu. and for the 21 years to 37.7 bu. This was the same fertilizer application that raised the continuously grown wheat from 7.5 to 19.3 bu.

In a 5-year rotation with corn, oats, clover, and timothy, wheat without fertilizer treatment yielded 8.7 bu. per acre in 1915 and 10.6 bu. as the 22-year average on land that had never been limed, as compared with 15 bu. for 1915 and 11.7 bu. for the 22 years on land which had received a ton of quicklime per acre in 1903 and 2 tons of ground limestone 10 years later. Acid phosphate

at the rate of 160 lbs. per acre increased the yield for 1915 to 18.6 bu. on the unlimed land and to 20 bu. on the limed land. One hundred lbs. muriate of potash added to the acid phosphate produced a further increase of a bushel per acre for the 22 years in both cases, and the complete fertilizer in the same quantities given for the experiments above described increased the yield for 1915 to 33 bu. on both unlimed and limed land and to 27.5 bu. for the 22-year average, the nitrate of soda partly taking the place of lime.

In addition to these plat experiments, a 40-acre field at the station has grown 10 acres of wheat annually for 22 years in a 4-year rotation with corn, oats, and clover. The first 10 years the wheat land was top-dressed before seeding with about 10 tons of barnyard manure per acre and the 10-year average yield was 20 bu. Then the manure was reinforced with about 40 lbs. of acid phosphate per ton and spread on clover sod which was plowed under for corn. The corn received a dressing of about 1.5 tons of limestone per acre and the wheat received 350 lbs. per acre of a fertilizer made up of steamed bone meal, acid phosphate, and muriate of potash with 50 lbs. of nitrate of soda added in April if the growth was not too rank. The wheat yield on this field for 1915 was nearly 36 bu., and the average yield for the past 10 years 34 bu. per acre.

HORTICULTURE.

[Report of horticultural investigations], W. H. LAWRENCE and S. B. JOHNSON (*Arizona Sta. Rpt. 1915, pp. 539–552*).—A progress report on various lines of work for the year.

Studies with processed fabrics prepared for use in protecting citrus trees during injurious low temperatures (E. S. R., 33, p. 48) were continued, and observations reported as to semitransparency, air-tightness of covers, radiation of heat from covers, distribution of heat, and changes of temperature due to wind currents under covers.

The results are given of fruit-thinning experiments conducted with a number of young date trees. These results, together with observations and study of the influence of thinning fruit on old trees, led to the following conclusions:

"The date palm is a plant having a natural method of thinning fruit. The fruit begins to drop shortly after pollination takes place and continues long after the reduction to one of the three carpels occurring in each floral cup, sometimes continuing into the harvest period. Trees not bearing a maximum crop will mature fruit to size and quality with little or no change in earliness of ripening. Natural methods of thinning fruit early in the season have a greater tendency to increase the size of the berry, in proportion to the number in the bunch, than is induced by artificial removal of a number of berries later in the season following natural thinning. Artificial thinning may be done to advantage only after the bearing capacity of a tree has been determined.

"Thinning may be done most effectively and quickly by the removal of an entire fruiting branch. This method not only increases the weight of the berry but of the entire bunch, including the brush. Thinning may be done profitably when the tree is carrying in excess of a maximum load. Under these conditions bunches with one-half the spikes removed begin to ripen their fruit earlier than the nonpruned bunches, which come second in order, while those with one-half of each spike removed mature the fruit more slowly. In general, fruit of inferior size occurs on the slender-stemmed bunches, bearing weak branches."

In a cultural test of winter radishes the white varieties gave the best results. For rate of maturity and length of time the roots continue to grow and remain edible, White Icicle was the first choice.

Some data are given on the range of soil temperatures during the season, and the importance of using such records to determine dates for planting, methods of irrigation, and rate of growth of vegetables until edible maturity is pointed out.

Observations and data secured from experiments in the station's European and American grape vineyard during the fruiting seasons of 1914 and 1915 are here summarized under the general headings of bearing habits of the plant, systems of pruning, yields per season, date of blooming, weight of average size bunches, date of picking, decrease in size of berries, decrease in number of berries per ounce, comparison of yields for separate pickings from all hills of each variety, and yield of fruit.

In an olive orchard planted late in March and early in April, 1914, it was noticed early in May that many of the trees were discolored. Near the middle of the month a considerable increase in the cankered areas was noted, but all attempts to isolate an organism gave negative results. A further study showed that the trouble made its appearance on the trees first on the south or southwest side and near the ground.

Some experimental work was carried on in which plantings were made under various conditions, and it was found that sun scald of newly planted olive trees occurs under certain conditions. Small, weak-growing trees usually died before sun scalding took place, while large growing stems were not affected. Shading the trees did not prevent sun scald, while flooding with irrigation water and the use of hot soil as a surface mulch, with subirrigation, favored the scalding. Medium-sized trees that gave up their water slowly were found most susceptible to the injury. Scalding took place only during periods of intense heat, and under average field conditions is limited to the area just above the ground. Fall, winter, or early spring planting is deemed more desirable than late spring planting, and trees should be headed back at the time of planting in order to reduce the evaporation as much as possible.

Report of the horticultural department, J. E. Higgins (*Hawaii Sta. Rpt. 1915, pp. 20–27, pls. 2*).—The work of the department was continued along lines previously noted (E. S. R., 32, p. 741).

The station is cooperating in experiments in Florida and in California with the view of extending the culture of litchi (*Litchi chinensis*). Some successful experiments in transporting these short-lived seeds under refrigeration from Honolulu to San Francisco and thence by ordinary express and by mail in moist sphagnum moss to Washington, D. C., and to various localities in California are noted. All of this seed germinated well, thus indicating that litchi seeds may be transported where refrigeration for fruit is available.

In the work with mangoes some preliminary studies have been made on the flowers of certain varieties and on methods of pollination. Several mango seedlings less than nine months old, which had been grafted by inarching, were found to be producing flower clusters above the point of union, and in most cases the scion also was flowering. The mango tree ordinarily does not flower until it is from five to six years old. No cause is ascribed for these phenomena, except the grafting. An instance of bud mutation is reported in which a single branch of one of the trees bearing green fruit produced a pink fruit rather smaller in size than the regular type but otherwise resembling the variety. Bark grafting the mango, which has previously been successfully applied by the Porto Rico Experiment Station, has proved to be well adapted under Hawaiian conditions to the work of top grafting established trees. The process is here described.

In the work with avocados the Macdonald, the parent tree of many of the round, hard-shelled winter seedlings, has attracted some attention by its remarkable keeping qualities. The fruits were kept in the horticultural laboratory for 16 days without any refrigeration, being in a perfect state of preservation at the end of this time.

In the work of propagating the avocado, scion budding has given satisfactory results. The scions are inserted in a T-shaped incision similar to that made for shield budding, only much larger. After being tied in place the budded scion is waxed with a firm grafting wax which will not run when heated by the sun. This method is considered to be advantageous as a means of propagating from old bearing trees which frequently do not produce good bud wood unless severely cut back. It may also be used to work branches of considerable size. Observations of apparently multiple-stemmed seedling avocados showed that such seedlings have a single central stem, the other stems arising from buds on this stem beneath the surface of the ground and in many cases within the seed.

The work of breeding papayas was resumed along lines previously noted. A number of crosses and close pollinations have been made to secure information on questions arising in earlier work.

In the citrus orchard many varieties are now in bearing and making a satisfactory growth. Practically all of these varieties have been introduced as bud wood and worked upon home-grown stocks.

In view of the claim by some manufacturers that a blend of the oil of kukui (*Aleurites moluccana*) and of the China wood oil (*A. fordii*) is preferable to either one, some work was undertaken by V. S. Holt in hybridizing these species with the idea that the new forms might combine the desired characters in a way superior to either of the parents. A number of fruits from these cross pollinations have been secured.

Brief notes are given on the station's distribution of seeds and plants and extension work in horticulture.

A variety test of tomatoes, C. E. MYERS (*Pennsylvania Sta. Rpt. 1914, pp. 461–492*).—In continuation of a previous report (E. S. R., 34, p. 146) tabular data are given on a test of different strains of a number of varieties of tomatoes. With a few exceptions each variety recorded has been tested for three years. The varieties are classified according to their period of maturity, described, and discussed with reference to their quality and commercial importance.

Influence of dynamiting on soils, W. R. WHITE (*Pennsylvania Sta. Rpt. 1914, pp. 445–457*).—In continuation of a previous report (E. S. R., 34, p. 125) the second year's results are given from those dynamiting experiments, which were conducted in orchards. Although these results are not considered conclusive thus far, they indicate, as in the previous year, that the profitable application of dynamite as a soil improver is limited. In these experiments no important gains have as yet been derived from its use either with newly-planted apple trees or with mature trees.

Irrigation, R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 24–26, fig. 1*).—Practical suggestions are given for irrigating orchards, both where cover crops are used and where clean tillage is practiced.

Cover crops, C. I. LEWIS and R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, p. 29*).—Notes are given of a test of various cover crops on a number of distinct soil types in the fall of 1914. The crops tested include field peas, horse bean, crimson clover, hairy vetch, spring or common vetch, woolly-podded vetch, purple vetch, and bitter vetch.

As a result of the severe winter only the crimson clover and hairy vetch survived and made satisfactory growth to be of value for green manuring. The

authors point out, however, that field peas may be grown in the spring for green manure as well as for forage or for grain. Crimson clover reaches the proper size for use as green manure too late in the spring to be of very great value. Of the newer vetches—woolly-podded, bitter, and purple—the first two are promising but do not appear to be much more hardy than spring vetch. Spring vetch succeeds well in ordinary years and, unlike hairy vetch, the seed is cheap and easily obtained, hence it will of necessity be most generally used.

Results from experiments on cultural methods, cover crops, and fertilization in apple orchards, J. P. STEWART (*Pennsylvania Sta. Rpt. 1914, pp. 423–438*).—In continuation of a previous report on this subject (E. S. R., 34, p. 148) the author reviews some of the more practical results secured from certain of the orchard fertilizer experiments. The principal results from the other orchard experiments of the station are appended in tabular form.

The results secured from cultural methods in the younger orchards are, in general, not materially different from those previously given. Some of the recent results in the more mature orchards, however, conflict with previous results, the tillage and cover crop plats giving the best yield in some cases and mulched trees the best yield in other cases. In the latter cases definite amounts of plant food have also been added to both the cultural plats and the mulched plats. Tree growth has continued to be decidedly greater throughout the experiment for the tillage and cover crop treatment.

Observations on the experiments as a whole appear to demonstrate the feasibility of obtaining practically annual crops from such supposedly refractory biennial bearers as the Baldwin, York Imperial, Spy, and Tompkins King, provided the conditions are made right. The results also indicate that annual tillage should be done with double-action disks or cutaways or their equivalent in preference to regular plows, wherever the soil conditions will permit.

In one experiment, here noted, the influence of fertilization surpassed that of cultural methods as regards yield. The application of nitrogen with phosphate to sod or of manure to sod gave strikingly greater yields than sod mulch or tillage and cover crop methods of culture. Phosphate with potash applied to sod gave a material gain over sod alone but was less effective in influencing the yield than sod mulch or tillage and cover crop.

From the results secured in this work to date a general fertilizer formula carrying about 30 lbs. of actual nitrogen, 50 lbs. of actual phosphoric acid, and from 25 to 50 lbs. of actual potash, applied at the rate of 500 lbs. per acre to bearing trees, is recommended. Attention is called, however, to the need of adjusting the fertilizer to individual orchards.

Intercrops for apple orchards, J. P. STEWART (*Pennsylvania Sta. Rpt. 1914, pp. 439–445*).—In this paper the author calls attention to the value of intercrops in reducing the cost of young orchards and gives concise directions for growing the various intercrops in the orchards.

The influence of nitrogen upon the vigor and production of devitalized apple trees, C. I. LEWIS and R. W. ALLEN (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 5–19, pl. 1, figs. 4*).—Further results are given of some of the station's orchard fertilizer experiments in which the ingredients are being applied both in the dry form and in solution (E. S. R., 35, p. 235).

The present report deals specifically with the effects of nitrogen, which is the only element that has given results. In the previous year's work beneficial results were secured by spraying trees with a solution of nitrate of soda and caustic soda, thus confirming the results reported by Ballard and Volck (E. S. R., 30, p. 640). Subsequent experiments, however, lead the authors to conclude that the real reason why better results were secured from spraying nitrate of soda than applying it in the dry form was due to the

fact that the nitrogen sprayed on the trees was dissolved and reached the roots, whereas the nitrates spread on the ground were added in May when the ground was dry, hence did not dissolve and reach the roots. In order to secure benefit from the nitrates they should be applied during the early part of March when the ground is sufficiently moist to dissolve them and also before the trees come into bloom. Nitrogen applied at this time has been found to cause a larger percentage of set of fruit in April, an important change in the character of the foliage, and a stimulation of the wood growth.

The experiments indicate that the stimulating effect of nitrate of soda is more lasting in its effects than formerly believed and that its benefits will extend over into the second season and perhaps longer. The best method of applying nitrate of soda to orchards is to spread the dry crystals broadcast on the ground under the trees and harrowing soon after applying. Six lbs. of nitrate of soda, equal to about 1 lb. of actual nitrogen, applied to a mature bearing tree is believed to be ample to restore seriously weakened trees to a normal condition. This amount should be reduced one-half the second year, the station's experiments showing that a full pound of nitrogen applied the second year produced too much wood growth and too much fruit that was undercolored and oversized. The cost of furnishing the required nitrogen at the rate recommended was $15 an acre.

The above amounts of fertilizer are recommended for use only on trees which are in a somewhat run down condition as indicated by thin foliage, weak wood growth, small fruit, and the presence of certain physiological troubles, such as "fruit pit," little leaf, die-back, etc.

Further experiments are to be conducted to confirm these conclusions as a whole.

The authors point out that nitrate of soda does not exert much influence on the soil, and therefore in order to improve the physical condition of the soil in many orchards it is necessary to add organic matter. During the last two years those orchards which have used clover and alfalfa in the presence of sufficient moisture have shown a strong improvement. The use of these leguminous crops should be dispensed with for a while and systematic clean culture practiced when signs of over stimulation appear.

Condition of root system of apple trees in the Hood River district, R. W. Allen (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 20–24, figs. 2*).—The results are given of a preliminary investigation started in 1913 to determine in a general way the condition of the root system of apple trees in orchards varying in age and under different cultural treatment.

In the orchards examined many of the fibrous roots of the trees were dead, this condition being worse in old orchards kept under clean cultivation and without irrigation. Sod culture without irrigation was very similar in result to that of continuous clean culture, but the conditions, as a whole, were worse where shallow implements of tillage had been used. Sod culture in which clover had been grown with irrigation showed the soil and roots of trees to be in very good condition.

"Fruit pit" was found to be worse under the worst conditions of the soil and upon trees having root systems in the most critical condition. In less serious conditions of soil the roots of "pit" trees were either normal in vigor or nearly so. Winter injury appeared to be most prevalent on soils of poor condition, but no relation was found to exist between the seriousness of the trouble and the condition of the roots of the trees. The investigation as a whole strongly indicates that the weak and yellow condition of the trees, much of

the fruit pit, and winter injury now so prevalent in the orchards are due to drought and improper fertilization.

Winter injury to apple tree roots (*Wisconsin Sta. Bul. 268 (1916), pp. 15, 16*).—Observations made by the horticultural department on root killing of apple trees show that when there is a blanket of snow upon the ground even excessive variations in air temperatures do not cause much fluctuation in soil temperatures; hence cover crops which hold the snow aid in preventing winter-killing.

The results of one year's work further indicate that the roots arising from scions of hardy varieties of apples can withstand greater cold than roots of equal size developing from the stock. Considerable difference existed in the ability of scion roots of different varieties to resist low temperatures. Scion roots of the Wealthy, for instance, are much hardier than those of the Northwestern Greening. J. G. Moore of the station has observed that ordinarily no scion roots are produced the first year. Usually those produced the second season are small, and less than 50 per cent of the 3-year-old apple stock had any scion root development. Consequently too much reliance can not be placed upon the development of scion roots by young trees as a factor to enable the trees to resist winter conditions.

Ripening of growing parts of orchard trees and shrubbery, A. D. Selby (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 206–208, fig. 1*).—Attention is called to the danger of the unripened condition of orchard trees and shrubbery due to various causes, with suggestions for the ripening of the wood so that winter injury does not follow. Among the causes of the unripened condition are heavy manuring, excessive pruning, late cultivation, defoliation by leaf spot and other fungi, etc.

Suggested grades for peaches, M. A. Blake and C. H. Connors (*New Jersey Stas. Circ. 58 (1916). pp. 8, figs. 4*).—In continuation of suggestions relative to grading peaches given in a previous bulletin of the station (E. S. R., 34, p. 639), the experience gained during 1915 is included in the present circular. A descriptive outline for standard varieties is given showing the amount of color these varieties should have to be classed as "fancy" fruit.

Horticultural observations in Porto Rico, Cuba, and Florida in relation to the horticulture of Hawaii, J. E. H. .gins (*Hawaii Sta. Rpt. 1915, pp. 58–73, pls. 3*).—A comparative study of the fruit industries in Porto Rico, Cuba, and Florida, with special reference to similar industries in Hawaii. The fruits considered include the pineapple, citrus fruits, the avocado, and the mango. Information is given relative to the extent of the industries, cultural methods, principal diseases and insects, and marketing.

FORESTRY.

Third biennial report of the state forester, 1914, J. C. Van Hook (*Bien. Rpt. State Forester Mont., 3 (1913–14), pp. 35, pl. 1*).—A brief account is given of the lumber industry in Montana, together with descriptions of the commercial woods of the State, methods of administering the state forests, and the work of forest protection.

Fifth annual report of the state forester, F. A. Elliott (*Ann. Rpt. State Forester Oreg., 5 (1915), pp. 22*).—A progress report on the work of the State Board of Forestry, with special reference to the work of forest protection.

Report of the state fire warden, C. P. Wilber (*Ann. Rpt. Dept. Conserv and Develop., N. J., 1915, pp. 47–77, pls. 3*).—The report of the 1915 season relative to the work of forest fire protection in New Jersey.

Report on forest operations in Switzerland (*Rap. Dépt. Suisse Int., 1915, pp. 1–10*).—A report on the administration and management of the state, community, and private forests in Switzerland, including tabular data showing yields in major and minor products, revenues, expenditures, etc., as well as operations in forest extension.

Report on the forest administration in Burma for the year 1914–15, C. G. Rogers (*Rpt. Forest Admin. Burma, 1914–15, pp. VI+109*).—The usual progress report relative to the administration and management of the state forests in Burma. including a financial statement for the year. The important data relative to alterations in forest areas, forest surveys, miscellaneous work, revenues, expenditures, etc., are appended in tabular form.

Annual report on the forest administration in Ajmer-Merwara for the year 1914–15, Hukam Chand (*Ann. Rpt. Forest Admin. Ajmer-Merwara, 1914–15, pp. 4+28*).—A report similar to the above relative to the administration of the state forests in Ajmer-Merwara during 1914–15.

Report on forest administration in the Andamans for 1914–15, J. W. A. Grieve (*Rpt. Forest Admin. Andamans, 1914–15, pp. 4+38*).—A report similar to the above relative to the administration of the state forests of the Andamans for the year 1914–15.

Administration report of the forest circles in the Bombay Presidency, including Sind, for the year 1914–15 (*Admin. Rpt. Forest Circles Bombay, 1914–15, pp. II+180+4*).—A report similar to the above relative to the administration of the state forests in the Northern, Central, and Southern Circles of the Bombay Presidency, and of Sind.

Progress report of forest administration in Coorg for 1914–15, H. Tireman (*Rpt. Forest Admin. Coorg, 1914–15, pp. 3+13+13*).—A report similar to the above relative to the administration of the state forests in Coorg for the year 1914–15.

Seeding and planting, J. W. Toumey (*New York: John Wiley & Sons, 1916, pp. XXXVI+455, figs. 140*).—A manual of information on seeding and planting in forest practice, with special reference to conditions in the United States. In the preparation of the work the forestry literature of Europe has been freely drawn upon for the principles underlying these practices.

In part 1, under the general heading of silvical basis for seeding and planting, consideration is given to definitions and generalities, the choice of species in artificial regeneration, the principles which determine spacing, and the principles which govern the composition of the stand. Part 2 takes up the artificial formation of woods, consideration being given to forest tree seed and seed collecting, the protection of seeding and planting sites, preliminary treatment of seeding and planting sites, establishing forests by direct seeding, the forest nursery, and establishing forests by planting.

The testing of pine seeds, A. Grisch (*Landw. Jahrb. Schweiz, 30 (1916), No. 2, pp. 210–224, figs. 2*).—A report on the knowledge of the count and weight methods of testing pine seeds.

Observations on some oaks with persistent foliage, G. Donati (*Ann. Bot. [Rome], 13 (1915), No. 2, pp. 157–168, figs. 13*).—The author here presents a comparative study of the leaf structure of *Quercus ilex*, *Q. suber*, *Q. occidentalis*, and *Q. coccifera*.

A list of the recognized woods of British Guiana (*New York: The British Guiana Consolidated Co., Ltd. [1916], pp. 18, figs. 6*).—A descriptive list of British Guiana woods compiled from various government reports. Information is given relative to the specific gravity of the wood, appearance, physical texture, and uses.

Rubber (*Trans. 3. Internat. Cong. Trop. Agr. 1914, vol. 1, pp. 594–728, fig. 1*).—This includes abstracts of the following papers on rubber, including reports of discussions, at the Third International Congress of Tropical Agriculture, London, July, 1914: The Cultivation of *Hevea brasiliensis* in Uganda, by S. Simpson (pp. 594, 595); Diseases of Hevea in Ceylon, by T. Petch (pp. 596–607); On Some Animal Pests of the Hevea Rubber Tree, by E. E. Green (pp. 608–636); *Termes gestroi* as a Pest of the Para Rubber Tree, by H. C. Pratt (pp. 637–640); The Principles of Hevea Tapping, as Determined by Experiment, by T. Petch (pp. 641–651); The Preparation of Plantation Para Rubber, by B. J. Eaton (pp. 652–678); Spottings in Plantation Rubber Due to Fungi, by A. Sharples (pp. 679–687); Ceara Rubber Cultivation and Manufacture in Southern India, by R. D. Anstead (pp. 688–696); The Cultivation of *Manihot glaziovii* in Uganda, by S. Simpson (pp. 697, 698); Increase in Yield from *Funtumia elastica* in Belgian Kongo by the Sparano Method, by A. Gisseleire (pp. 699–701); The Methods of Tapping Cultivated Castilla Trees, and the Yield of Rubber Therefrom, by P. Carmody (pp. 702, 703); The Methods of Tapping Castilla Rubber Trees in Mexico, and the Yield of Rubber Which the Trees Furnish, by A. Russan (pp. 704–712); Rubber Culture in the German Colonies, by F. Frank (pp. 713–719); Necessity to the Rubber Industry of the Exact Laboratory Determination of the Respective Values of Rubber, by Lamy-Torrilhon (pp. 720–722); and Contribution to the Knowledge of the Mechanism of Coagulation in Certain Rubber-Yielding Species, by F. Heim and R. Marquis (pp. 723–728).

A comparison of the Brazilian and plantation methods of preparing Para rubber, G. S. WHITBY (*Jour. Soc. Chem. Indus., 35 (1916), No. 9, pp. 493–502*).—In this paper the author describes a comparative test of the methods of preparing plantation rubber in the eastern Tropics and the wild rubber of Brazil.

The rubber industry of the Amazon and how its supremacy can be maintained, J. F. WOODROFFE and H. H. SMITH (*London: John Bale, Sons & Danielsson, Ltd., 1915, pp. XLVIII+435, pls. 42, figs. 4*).—This work comprises a study of the rubber industry and the labor, social, and various economic conditions in Brazil, with special reference to pointing out ways and means for the future development and maintenance of the rubber industry in connection with the general development and settlement of the Amazon region.

DISEASES OF PLANTS.

Plant pathology problems (*Wisconsin Sta. Bul. 268 (1916), pp. 18–25, figs. 6*).—Brief accounts are given of the various investigations in plant diseases that are being carried on by the department of plant pathology. This work includes a study of leaf roll and similar troubles of potato, seed disinfection for the control of scab and Rhizoctonia, studies of nonparasitic diseases of potato such as black heart, a study of alfalfa diseases, and the control of barley diseases, cabbage yellows, and cucumber diseases.

For the control of barley diseases, A. G. Johnson has investigated the effect of planting at intervals of two weeks throughout the season with the result that the early plantings in most cases developed more disease than the midsummer plantings. Attempts were made to control the stripe and blotch of barley by treating the seed with hot water, solutions of copper sulphate, copper sulphate and salt, corrosive sublimate, and formalin, with the result that warm solutions of formalin proved to be the most satisfactory treatment. Soaking seed for three hours in a solution of 1 pint formalin to 30 gal. water at a temperature of 68° F. gave satisfactory control not only of the stripe disease but also of the loose and covered smuts.

The work begun by the department of plant pathology some years ago in developing resistant strains of cabbage has resulted in the establishment of such strains and the production of a considerable amount of seed for testing in 1916. Trials made in different regions indicate that the disease-resistant quality is maintained even in widely different localities. In connection with this disease, J. C. Gilman has observed that the growth of the parasitic organism causing it is greatly increased at temperatures above 64°. This, it is believed, will explain why the disease is so much more serious in some seasons than in others, and also indicates that it will not be so severe in the northern as in the southern parts of the State.

Some observations on pea blight were continued, and the former recommendations of careful preparation of seed bed and attention to drainage are repeated. For the disposal of the refuse vines the use of silos is suggested.

Some investigations had been begun on cucumber diseases, of which wilt, angular leaf spot, anthracnose, and scab are said to be due to definite parasites, while a fifth, white pickle or cucumber mosaic disease, is not known to be due to any organism. These five diseases are said to be more or less serious in Wisconsin. The white pickle or cucumber mosaic disease is characterized by irregular malformed fruits which are usually worthless for pickling purposes. The trouble is considered transmissible, but as yet no parasite has been discovered. Similar conditions have been found to obtain with squash and watermelon, from which the disease may be transferred to the cucumber.

Studies on the crown gall of plants. Its relation to human cancer, E. F. Smith (*Jour. Cancer Research, 1 (1916), No. 2, pp. 231–309, figs. 92*).—The present paper, which reviews certain of the essential features of crown gall, especially as they bear upon the general problems of cancer, also contains a number of new observations which are considered to bring this vegetative growth into relations with the group of tumors described as embryomata.

The author calls attention to the growth without function exhibited by the crown gall tumors, the cell itself being properly regarded as parasitic only in the sense that it is urged on by a schizomycete, *Bacterium tumefaciens*, and to the embryonic character of the proliferating tumor cells. Attention is called also to the atypical arrangement of the tissues, to their loss of polarity, and to the slight differentiation of the cells accompanying their increase in vegetative vigor. The neoplastic character of the growths is emphasized by the noncapsulate marginal growth, the imperfect vascularization, the early central necrosis, the existence of intrusive strands, and the occurrence of daughter tumors, which reproduce the original tumor. The same micro-organism is capable of producing by inoculation different types of tumors varying in structure according to the type of tissue invaded, the most complex type containing, along with blastomous elements, a jumbled and more or less fused mass of embryonic organs and fragments of organs comparable, if not equivalent, to the foetal organs occurring in the atypical animal teratoids.

The distribution of black rust in Norway, E. Henning (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 107 (1915), pp. 16; K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 2, pp. 122–135; abs. in Bot. Centbl., 128 (1915), No. 18, pp. 495, 496*).—It is thought that the barberry was introduced into Scandinavia at least as early as the beginning of the seventeenth century, and black rust of wheat (*Puccinia graminis*) not later than the eighteenth, and possibly in the seventeenth, century. Since this time the barberry has been used as alternate host, both barberry and fungus being more successful in the middle and southern portions than in the north, where the rust has little economic importance.

Diseases of garden vegetables in Switzerland, E. MAYOR (*Rameau Sapin, 48 (1915), pp. 39, 40, 44–47; 49 (1915), pp. 7, 8, 12–15; abs. in Bot. Centbl., 129 (1915), No. 1, p. 6*).—A brief review is given of diseases of garden vegetables, particularly in the Canton of Neuchâtel, also of corresponding control measures.

The physiology of Phoma betæ, R. SCHANDER and W. FISCHER (*Landw. Jahrb., 48 (1915), No. 5, pp. 717–738*).—Reports of previous investigations by one of the authors (E. S. R., 28, p. 628; 33, p. 53) are followed up with a detailed account of studies on *P. betæ* as affected by modifications of the nutritive medium, by temperature, and by poisons as employed in sprays.

Hot water does not seem to be practically protective against this fungus. Among the more satisfactory chemical sprays mentioned are corrosive sublimate and a few proprietary preparations.

Club root of cabbage, C. HAMMARLUND (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 106 (1915), pp. 14, figs. 7; K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 2, pp. 110–121, figs. 7*).—Experiments on control of cruciferous club root (*Plasmodiophora brassicæ*) gave results which were most favorable to formalin in regard to the expense, which is only one-third that of carbon bisulphid, and in regard to its harmlessness as compared with lime in large percentages. It was proved that the disease is spread by feeding the diseased plants to cattle, which does not destroy the organism, though its dispersal in this way may be avoided by thoroughly cooking the plants.

Glœosporium caulivorum injuring red clover in Hungary, D. HEGYI (*Mezögazdasági Szemle, 33 (1915), No. 2, pp. 55–58; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 4, p. 637*).—In different portions of Hungary, but particularly those along the right bank of the Danube, great injury was done in 1914 to red clover by *G. caulivorum*. As the fungus is thought to be carried by the seeds, it is recommended that these be soaked in 1 per cent solution of copper sulphate before planting.

Transmission and control of bacterial wilt of cucurbits, F. V. RAND and ELLA M. A. ENLOWS (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 11, pp. 417–434, pls. 2, figs. 3*).—The authors have made a study of insect transmission of the bacterial wilt of cucurbits. Experiments, as far as completed, indicate that cucumber beetles (*Diabrotica* spp.) are the most important, if not the only, carriers of the wilt organism (*Bacillus tracheiphilus*), and that at least one species (*D. vittata*) is capable of carrying the wilt over winter and infecting the spring plantings of cucumbers.

In spraying experiments carried on in 1915, the wilt was effectively controlled by a spray consisting of a combination of Bordeaux mixture and arsenate of lead. Plats sprayed with either alone showed less wilt than unsprayed plats, but the control was not so complete as when the two were used together. Inasmuch as it has been proved that insects are the carriers of the disease, insect control becomes necessary for preventing the wilt. This phase of the work is to be given further study in cooperation with the Bureau of Entomology of this Department.

Bacteriosis of cucumber in Italy, G. B. TRAVERSO (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 5, pp. 456–460*).—A serious bacterial disease of cucumbers is described as having appeared in May, 1914, following a severe outbreak of *Glœosporium lagenarium* in 1913. The disease appears on the adult leaves and the fruits while the roots and young shoots are still normal. Bordeaux mixture, if applied to the plants when very young, is thought to have some protective value.

Leaf rust of cucumber, P. SPRENGER (*Mitt. K. K. Gartenbau Gesell. Steiermark, 41 (1915), No. 1, pp. 4, 5; abs. in Bot. Centbl., 128 (1915), No. 15, p.*

415).—Against *Corynespora melonis*, causing a spread of leaf rust in Germany, a 1 per cent Bordeaux spray for the young plants is recommended as preventive. Seed should be kept for 1.5 hours in 0.5 per cent formalin before sowing. After the outbreak has occurred, it is necessary to destroy completely all plants with their fruits, or to remove them to some unused portion of the field which can be left uncultivated for several years.

Ginseng diseases and their control, H. H. Whetzel, J. Rosenbaum, J. W. Brann, and J. A. McClintock (*U. S. Dept. Agr., Farmers' Bul. 736* (*1916*), *pp. 23, figs.26*).—This describes in a popular way the diseases of ginseng and their control, technical descriptions of the different diseases having been previously noted (E. S. R., 27, p. 649).

The neck rot of white onions, J. G. Humbert (*Mo. Bul. Ohio Sta., 1* (*1916*), *No. 6, pp. 176–180, fig. 1*).—Results from an investigation on the neck rot of white onions, due to *Sclerotium cepivorum*, are given. This disease is said to have been the cause of heavy loss in stored onions, and experiments for control, including sanitation methods and fumigation with formaldehyde gas, have been carried on with some success. Dump heaps of rotting onions should not be permitted, and crates and storage houses should be disinfected if the new crop is to be kept free from disease.

This disease has been confused with smut, but this attacks the growing onions, while the neck rot is apparently a trouble which destroys the mature onions in storage.

Potato dry spot in Java, A. Rant (*Teysmannia, 26* (*1915*), *No. 5, pp. 285–287, pls. 2*).—A disease of potato leaves is described which is thought to be identical with early potato blight due to *Alternaria solani*.

Root rot of tobacco (*Wisconsin Sta. Bul. 268* (*1916*), *pp. 17, 18, figs. 2*).—A brief account is given of the work of J. Johnson on the rooot rot of tobacco, due to *Thielavia basicola*, and methods for its control. Since certain strains of tobacco have been found to differ widely in susceptibility to the disease, an attempt is being made to develop a resistant type which will be of high quality and also able to grow on worn-out tobacco fields. Until such a type is secured, it is recommended that growers sterilize the soil of seed beds or plant on soil that has not grown tobacco in recent years.

Bacterial rot of tomato, V. Peglion (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24* (*1915*), *II, No. 3, pp. 157–160*).—A rot of tomato appearing in May, 1914, was reproduced in characteristic form by inoculation with a bacterium isolated from the decayed fruits. The organism appears to lose quickly much of its virulence in artificial substrata.

Root rot of fruit trees, J. J. Thornber (*Arizona Sta. Rpt. 1915, p. 530*).—In continuation of work by McCallum, discontinued in 1910, the author made an examination of orchards where root rot was causing serious loss. It is considered that more than one fungus is responsible for root rot, and in the absence of definite information, no positive methods for control can be given. This investigation is to be continued.

Study of Coniothyrium pirina, Phyllosticta pirina, and C. tirolense, Elisa Mutto and G. Pollacci (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24* (*1915*), *II, No. 1, pp. 40–42*).—Evidence is adduced to show that the fungus denominated *C. pirina* by Sheldon (E. S. R., 19, p. 249) is, as that author suspected, not identical with *P. pirina* but that it has characters corresponding precisely to those of *C. tirolense*.

Tree crickets as carriers of Leptosphæria coniothyrium and other fungi, W. O. Gloyer and B. B. Fulton (*New York State Sta. Tech. Bul. 50* (*1916*), *pp. 3–22, pls. 4*).—The authors propose the name tree-cricket canker for a disease

of apple branches, in which areas of dead bark infested with *Coniothyrium fuckelii* surround oviposition punctures of tree crickets.

The constant association of this fungus with such cankers led to an investigation of tree crickets as its carriers. It was found that tree crickets may carry the fungus from raspberries to apple trees and infect them, and also that they may carry the spores of these and other fungi in the digestive tract as well as on the outside of their bodies. Feeding experiments showed that the spores of *Ustilago zeæ*, *Coprinus micaceus*, *Coniothyrium fuckelii*, *Nummularia discreta*, and *Sphæropsis malorum* passed through the digestive tract of tree crickets without loss of viability.

Typical cankers resulted when tree crickets fed on *C. fuckelii* were allowed to oviposit on apple branches. The percentage of cankers formed about oviposition punctures was considerably greater when the crickets were fed with *C. fuckelii* from raspberry canes than when they were fed with pure cultures of the fungus isolated from apple branches. The oviposition punctures of *Œcanthus niveus* gave a higher percentage of infection than those of *Œ. angustipennis*, and for both species the percentage of infection was considerably higher when the punctures were covered with grafting wax than when left uncovered. Typical cankers were also produced by inserting pellets of tree-cricket excrement into punctures made in apple branches and covering them with grafting wax.

Clean cultivation and the use of arsenical sprays are suggested as remedial measures for the control of tree crickets.

Collar blight of apple trees, C. R. Orton and J. F. Adams (*Pennsylvania Sta. Rpt. 1914, pp. 152–160, pls. 3*).—This is an account of an investigation of collar blight of apple trees, due to the organism *Bacillus amylovorus*, a more extended report of which has been noted (E. S. R., 34, p. 247).

The spraying experiments of 1915 in the Hood River Valley for the control of apple scab, J. R. Winston and L. Childs (*Oregon Sta., Rpt. Hood River Sta. 1915, pp. 30–46, figs. 5*).—A report is given of experiments carried on in the Hood River Valley for the control of apple scab which, in the last few years, has become a very serious pest in this region. In 1914, cooperative experiments were carried on with a number of growers, and in 1915 work was continued on three orchards in which Winesap and Newtown apple trees were sprayed with various fungicides to test their efficiency. Bordeaux mixture, soluble sulphur, barium tetrasulphid, atomic sulphur, and iron sulphid were tested in comparison with lime-sulphur solution. In addition, the time of application was studied, particular attention being paid to the delayed dormant application, in which trees were sprayed with a rather strong lime-sulphur solution just as the leaves were beginning to show from the winter buds.

The delayed dormant application proved valuable in some instances, increasing by about 12 per cent the sound fruit. Lime-sulphur proved the most efficient fungicide tested, the addition of atomic sulphur in one instance apparently decreasing its fungicidal properties, and the addition of iron sulphid apparently decreasing the fungicidal properties and slightly increasing the injurious qualities. Bordeaux mixture caused serious russeting of the fruit. The barium tetrasulphid used in strengths recommended by the manufacturers did not prove so efficient as lime-sulphur in controlling scab. Atomic sulphur proved a very poor substitute for lime-sulphur in the later applications. Soluble sulphur was less efficient and decidedly more injurious than lime-sulphur, but it was more efficient than atomic sulphur, iron sulphid, or barium tetrasulphid.

Based on two years' work, the authors claim that by thorough application of fungicides apple scab may be controlled in the Hood River Valley, even in years favorable to epidemics of the disease. A tentative spray calendar for

1916 is given for the control of scab and mildew, or of scab alone, in the Hood River Valley. This includes the use of lime-sulphur as a delayed dormant spray, followed by a more dilute lime-sulphur just as the petals are beginning to open, with a third spraying immediately after the petals have fallen. In the third spraying the authors recommend the use of atomic sulphur if the weather is clear and warm, or lime-sulphur with atomic sulphur added if the weather is cool and rainy. Two other applications are recommended, depending upon conditions in the orchards. In the first application, for the control of purple aphis nicotin may be used, and in the third and fifth lead arsenate may be added to the fungicide as a protection against codling moth injury.

Six years of experimental apple spraying at Highmoor Farm, W. J. MORSE (*Maine Sta. Bul. 249 (1916), pp. 81–96*).—In previous publications (E. S. R., 33, p. 648) accounts have been given of the results obtained from spraying experiments for control of apple scab. In the present bulletin an attempt is made to present a general summary of the more important results obtained. The primary object of the experiments was to determine an efficient and economical control of apple scab with a minimum amount of injury to fruit and foliage, as applied under Maine conditions. With the different fungicides, arsenate of lead was added as an insecticide at the rate of 2 lbs. of paste or 1 lb. of powder to 50 gal. of solution.

A comparison was made of 3:3:50 Bordeaux mixture and a standard dilution of lime-sulphur which was equivalent to a 1 to 40 dilution of a 33° Baumé concentrate. Bordeaux mixture, while efficient in scab control, nearly always caused serious leaf injury, and sometimes resulted in a considerable russeting of the fruit. Lime-sulphur of standard dilution gave little leaf injury, but was somewhat less efficient in controlling the disease.

The effect of different dilutions of lime-sulphur was investigated, and a spray containing 25 per cent less of the concentrate than the standard dilution resulted in the appearance of more scab than where the standard dilution was used. A comparison was made between the standard dilution and one 20 per cent stronger for four successive seasons, and it appears that on the Ben Davis apple a solution of lime-sulphur at least 20 per cent stronger than the standard dilution can be used with comparative safety.

The importance of a first application at the time of the blossoming period was also tested, and while some increase was given during certain seasons, yet the general results indicated that failure to spray at this time did not greatly reduce the efficiency of subsequent applications.

Arsenate of lead used alone in the progress of these experiments was found to have considerable value as a fungicide. In some instances trees receiving arsenate of lead gave almost as good control as where the insecticide was used in combination with the fungicide.

Notes are given on the effect of strong fungicides used as a first application followed by arsenate of lead alone, and the effect of dormant sprays for insects used in combination with the regular summer sprays. A comparison was made between self-boiled lime-sulphur and other forms of this fungicide which indicates that it is less efficient than the dilutions made from certain commercial brands of lime-sulphur concentrate. A trial was made of copper-lime-sulphur which indicated that, so far as scab control is concerned, it is about as efficient as the same dilution of lime-sulphur, but the presence of copper resulted in considerable foliage injury. Extra fine sulphur flour was found to possess considerable fungicidal value.

Comparative tests were made of a number of proprietary spraying compounds. Sulfocide, while efficient in scab control, caused a considerable amount of

injury to the fruit. Soluble sulphur was tested two years, and while it proved an efficient fungicide, at the dilutions tested it is considered unsafe as a summer spray for apple foliage. Another proprietary compound used was atomic sulphur. This caused no injury to the fruit or foliage, and scab control and percentage of perfect apples was nearly the same as that secured with lime sulphur.

"Sooty blotch" of the pear, E. S. SALMON and H. WORMALD (*Gard. Chron., 3. ser., 59 (1916), No. 1518, pp. 58, 59, figs. 4*).—Sooty blotch of pear and apple is described, with the differences apparent between these two hosts. It is considered probable that the disease is caused by *Leptothyrium carpophilum*, though the pycnidial stage of the fungus has not yet been found. The disease is distinguished from scab (Fusicladium) by the fact, among others mentioned, that the sooty blotch develops after the fruits are stored.

Crown gall on raspberries and blackberries, P. THAYER (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, p. 218*).—An account is given of a study on the occurrence of crown gall on raspberries and blackberries. In 1911, 99 rows, including all the leading varieties of blackberries and raspberries, were planted, and in 1916 the plantation was dug out and the plants all inspected. Of the black and purple raspberries, not a single sound plant was found and all varieties of red and yellow raspberries were more or less subject to root gall, although there was considerable variation in the amount of infection. A marked immunity was shown by the blackberries. With the exception of a few nodules found on the variety Lawton and a few canes of McDonald not a single plant of the native varieties of blackberry was found affected.

[Grape diseases] (*Bol. Agr. [São Paulo], 16. ser., 1915, Nos. 10, pp. 836–845; 11, pp. 921–936, figs. 4; 12, pp. 1017–1022, figs. 2*).—Information is given regarding two fungus diseases of grape, *Peronospora viticola* and *Oïdium tuckeri*, which cause loss in São Paulo, also regarding their control by copper and other sprays employed in connection with these two diseases.

Citrus canker, F. A. WOLF (*Alabama Col. Sta. Bul. 190 (1916), pp. 91–100, pls. 2, figs. 6*).—In a previous publication, the author gave an account of investigations of citrus canker (E. S. R., 35, p. 152). The present publication contains a brief account of the more important results of these investigations, together with a compilation of information drawn from other sources.

A disease of the oil palm in the Belgian Kongo (*Bul. Imp. Inst. [So. Kensington], 13 (1915), No. 3, pp. 479, 480*).—Attention is called to a fungus thought to be identical with *Ganoderma tumidum*, attacking as a rule mature, but also sometimes young, palm trees in the Belgian Kongo. The fungus may persist after the death and disintegration of the tree. It is suggested that all diseased trees be totally destroyed and the affected area surrounded by a trench 2 ft. deep and treated with freshly slaked lime.

Septoria disease of chrysanthemum, R. LAUBERT (*Handelsbl. Deut. Gartenbau, 30 (1915), pp. 17, 18; abs. in Ztschr. Pflanzenkrank., 25 (1915), No. 2, p. 118*).—Besides noting a severe local attack of *S. chrysanthemella* on *C. indicum* in Zehlendorf in December, 1914, the author discusses the previous distribution and developmental conditions of this disease.

Causation and control of breaking sickness in tulips, C. HAMMARLUND (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 105 (1915), pp. 23, pl. 1, figs. 5; K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 2, pp. 89–109, pl. 1, figs. 5*).—Giving an account of studies on tulips, which, after blooming normally, suddenly developed a break in the stem, the author claims that the trouble is due to means used to force development. Measures recommended to prevent the weakness are avoidance of very close planting, of excessive watering, and of a close, damp atmosphere in the hothouse.

Pathological observations on the chestnut in southern Indiana, J. R. Weir (*Ann. Rpt. Ind. Bd. Forestry, 15 (1915), pp. 140–163, figs. 8*).—The author has investigated the conditions in regard to the chestnut tree in southern Indiana for several years, primarily with reference to the chestnut bark disease, but information is given regarding the presence and habits of a large number of other fungi, mostly saprophytic, on chestnut, the chestnut blight fungus (*Endothia parasitica*) not having been found by him. A large amount of other information is presented regarding the forest growth.

The white pine blister rust, P. Spaulding (*U. S. Dept. Agr., Farmers' Bul. 742 (1916), pp. 15, pl. 1, figs. 5*).—A popular account is given of the white pine blister rust due to *Cronartium ribicola*, and the life cycle of the fungus through its host plants, white pines, currants, and gooseberries, is described. This disease, which has been introduced into this country from Europe, has spread rather extensively, 12 distinct new outbreaks having been observed in 1915. Suggestions are given for the control of the disease and the need of adequate state laws for its control is pointed out.

[Root disease of Para rubber], W. H. Johnson (*Rpts. Agr. Depts. North. and South. Provs. [Nigeria], 1914, pp. 24, 31*).—This report of the director contains an account of an outbreak of root disease in 1914 due almost exclusively to *Polyporus lignosus*, *Hymenochæte noxia* having been apparently eliminated by the removal in 1912 of all stumps known to be susceptible thereto.

A new disease in the Para rubber plantation at Calabar is due to a fungus believed to be *Ustulina zonata*, which in Ceylon causes a root disease of tea. The necessity for removal of the stumps is indicated.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A systematic account of the prairie dogs, N. Hollister (*U. S. Dept. Agr., Bur. Biol. Survey, North American Fauna No. 40 (1916), pp. 36, pls. 7, figs. 2*).—The so-called prairie dogs (*Cynomys* spp.) are divided into two general classes, (1) the black-tailed prairie dogs which form the subgenus Cynomys, consisting of three forms of two species, and (2) the white-tailed prairie dogs which form the subgenus Leucocrossuromys, consisting of four forms of three species. Prairie dogs are distributed over a large part of the Great Plains and Rocky Mountain regions and are of considerable economic importance, due mainly to their destruction of grasses and other forage plants.

Entomology, A. W. Morrill (*Arizona Sta. Rpt. 1915, pp. 563–565*).—The work with the harvester ant (*Pogonomyrmex barbata*) was continued during the season of 1915. Where 28.5 lbs. of London purple were required per acre in 1914 (E. S. R., 33, p. 57) only 2.5 lbs. were required in 1915 in the work of cleaning up the remnants of the old nests. The experiment shows that when once brought under complete control, the ants can be held to a point where they do no damage at a total cost each year of less than 40 cts. an acre.

Brief mention is also made of the work with the green June beetle (*Allorhina mutabilis*) and the clover or alfalfa seed chalcid fly. A trap border experiment with the latter, though carried on under unfavorable conditions, appears to have shown definite results.

Entomological investigations, 1915, L. Childs (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 47–61, figs. 2*).—The investigations here reported relate largely to the fruit tree leaf roller (*Archips argyrospila*) and to codling moth control work in 1915.

In experimental control work with *A. argyrospila* the best results were obtained from the use of lead arsenate at the rate of 6 lbs. to 50 gal. of water. Miscible oil also gave highly satisfactory results, and while more expensive

"the marked increase in efficiency attained with the oil more than warrants its use. For complete safety to the foliage, the oil applications should be made before the buds burst. Apparently no permanent injury occurred in our experimental plats this season from the late applications, but the margin of safety is extremely small and such a procedure should not be generally followed."

Codling moth infestation was very severe during 1915 throughout the entire Northwest, the loss from this source in the Hood River Valley being about twice that of 1914. In response to inquiries relative to the advisability of mixing the arsenate of lead with the fungicides, investigations were conducted with arsenate of lead in combination with lime-sulphur and iron sulphid, lime-sulphur and atomic sulphur, lime-sulphur and barium tetrasulphid, and with milled sulphur and Bordeaux mixture. In no case was the efficiency of the poison descreased.

It was found that during the year the greater percentage of worms entered the fruit through the side rather than at the calyx end. Experiments conducted show clearly that one application, whether it be the "calyx" or the one preceding the hatching of the eggs, will not control the moths. The station recommends two different schedules of sprays for the season of 1916. "The first two applications will be the same in both cases—that is, the calyx and '30-day' spray for the control of the first brood of worms. Where a loss of not more than 8 per cent was experienced in 1915, one well-timed summer spray should prove very effective in controlling the second generation. This should be applied in early August. The date will be dependent upon weather conditions. . . . Where the infestation during 1915 was found to be more than 8 or 10 per cent, two summer applications should be made to control the codling moth. The third spray should be made about July 20 and the fourth toward the middle or last of August."

Observations relating to the woolly aphis and strawberry root weevil are also briefly noted.

The locust borer (Cyllene robiniæ) and other insect enemies of the black locust, H. Garman (*Kentucky Sta. Bul. 200 (1916), pp. 99–135, pls. 22, fig. 1*).—The data here presented have previously been noted from another source (E. S. R., 35, p. 355).

Two troublesome pests of man, R. D. Whitmarsh (*Mo. Bul. Ohio Sta., 1 (1916), No. 7. pp. 221–224, figs. 2*).—Brief accounts are given of chiggers and sandflies and methods of prevention and control.

Aleyrodidæ, or white flies attacking the orange, with descriptions of three new species of economic importance, A. L. Quaintance and A. C. Baker (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 12, pp. 459–472, pls. 6, figs. 3*).—This paper brings together information on the distribution and food plants of the white flies which attack citrus plants, 16 in number, of which 3 of economic importance are described as new to science, namely, *Aleurocanthus citriperdus* from Ceylon, India, and Java; *A. woglumi* from India, Ceylon, Cuba, Jamaica, the Bahamas, and the Philippines; and *Aleurothrixus porteri* from Chile and Brazil.

A list of 20 references to the literature cited is included.

Studies of life histories of leafhoppers of Maine, H. Osborn (*Maine Sta. Bul. 248 (1916), pp. 53–80, pls. 5, figs. 8*).—This bulletin presents the results of studies made during the summer of 1914 in continuation of those begun in 1913 and previously reported upon (E. S. R., 33, p. 356).

A chemical analysis made of timothy by the station chemist indicates that the leafhoppers not only reduce the quantity but lessen the food value of the crop attacked.

Eight species are here considered, namely, *Cicadula sexnotata, Acocephalus albifrons, A. striatus, Chlorotettix unicolor, Idiocerus provancheri, Dræculacephala angulifera, Phlepsius apertus*, and *Balclutha punctata*, of which the first three mentioned are dealt with at some length. The six-spotted leafhopper (*C. sexnotata*), one of the first to invade new fields, produces several generations and is quite migratory in habit. After this, for Maine, *Deltocephalus minki* appears to be one of the earliest to appear in open fields, and later the froghoppers and *A. striatus* come in abundance. One of the latest and perhaps the least migratory is *A. albifrons*, termed the timothy crown leafhopper, since it lives down in the ground around the crowns of timothy.

The army worm in New York in 1914 (Leucania unipuncta), H. H. KNIGHT (*New York Cornell Sta. Bul. 376 (1916), pp. 751–765, pls. 8*).—Next to the serious outbreak of the army worm in 1896, studies of which were made by Slingerland (E. S. R., 9, p. 365), the outbreak in 1914 was the most serious that has occurred in New York State. This outbreak afforded an opportunity to gather considerable additional data, which are here reported.

The observations relate to food plants, place of development in Genesee County, life cycle, occurrence in 1915, natural enemies and methods of control, and the occurrence of an allied species, *L. pseudargyria*.

Comparative study of the amount of food eaten by parasitized and nonparasitized larvæ of Cirphis unipuncta, D. G. TOWER (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 12, pp. 455–458*).—In the author's experiment with the parasite *Apanteles militaris* it was found that the parasitized army worm ate approximately half as much as unparasitized larvæ during the same periods, and it seems conclusive that parasitism by *A. militaris* is directly beneficial in the generation attacked. "From the results obtained it might seem as though larvæ oviposited in at an earlier date would eat more before being killed, but the time spent in the host by the parasites seems to be fairly constant, and this was also noticed in a larger number of cases in former experiments with *A. militaris*. Hence, it is believed that in such cases the larvæ would have only approximately the same amount of time for feeding, and a larger portion of this period would occur during the earlier stages, when a much smaller amount of food is eaten, so that the amount eaten would be less than the normal for unparasitized larvæ."

The clover leaf tyer (Ancylis angulifasciana), H. A. GOSSARD (*Ohio Sta. Bul. 297 (1916), pp. 427–443, pls. 2, figs. 2; abs. in Mo. Bul. Ohio Sta., 1 (1916), No. 6, pp. 181–185, figs. 2*).—The author reports observations made of this insect since 1905, in the spring of which year his attention was drawn to the ragged, eaten condition of the clover leaves. Considerable damage was caused to clover at the station farm. Its appearance in injurious numbers seems to have been local, since the author has not observed it to be of importance elsewhere than at Wooster.

Red clover and alsike are said to have been very freely attacked in the field, white clover less commonly, and alfalfa not at all. Clover foliage eaten by the caterpillars presents a ragged appearance, the epidermis from one of the surfaces being either partly or wholly eaten away, while that remaining appears thin, papery, and white, except for minute splotches and streaks of green here and there. Either the upper or lower surface will be eaten, whichever happens to be turned inward in the cell.

The moths of the first brood appear in late April or early May and are nearly all gone by May 20. The eggs were found to require an incubation period of from two to three weeks. Three broods were observed.

"It is apparent that the first clover harvest, coming in late June and early July or earlier, will carry to the mow many of the larvæ and pupæ of the first

brood and that the second cutting will take off most of the second brood pupæ. Fall pasturage will destroy many of the third brood. Plowing old clover stubble in the spring preparatory to planting corn practically exterminates all larvæ in the field. The present well-established customs for harvesting and pasturing clover furnish a logical and effective program of control."

Effect of Roentgen rays on the tobacco, or cigarette, beetle and the results of experiments with a new form of Roentgen tube, G. A. Runner (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 11, pp. 383–388*).—This is a report of studies conducted in continuation of those previously noted (E. S. R., 29, p. 359).

"Under laboratory conditions, tests made with a Roentgen-ray tube permitting a high-energy input and giving an intense and powerful radiation gave results which promise that the X-ray process may be successfully used in treatment of cigars or tobacco infested with the tobacco, or cigarette, beetle. Heavy dosages must be given, as is indicated by the exposure given in the series of experiments tabulated in this paper. In treatment of the egg stage, heavier exposures are required to sterilize eggs which are near the hatching point than are required to sterilize eggs newly laid. In experiments performed by the writer a dosage equivalent to 150 milliampere minutes exposure with a spark gap of 5.5 in. gave satisfactory results with eggs in tobacco placed 7.5 in. from the focal spot of the tube. With this exposure the eggs in which embryonic development was well advanced hatched, but in all cases where these larvæ were kept under observation they failed to reach the adult stage. The minimum lethal dosage at a given distance from the focal spot of the Roentgen tube used has not been determined.

"In two separate experiments adults were given an exposure of 600 milliampere minutes (amperage × time), with a spark gap of 5.5 in., giving an approximate voltage of 65,000, with humidity at 57. The distance from the focal spot of the Roentgen tube was 7.5 in. The results are as follows:

"(1) No effect on length of life was apparent, as the beetles died at about the same rate as the same number of beetles kept as a check. (2) Large numbers of eggs were deposited after exposure. These eggs were infertile. Eggs laid by the check beetles hatched normally.

"Larvæ were given an exposure of 600 milliampere minutes, other conditions of the experiment being the same as in the experiments with adults given above. While no immediate effect was apparent, the treatment had the effect of stopping activity and development, the larvæ remaining in a dormant condition for a prolonged period. All treated larvæ died before reaching the pupal stage."

The alfalfa weevil and methods of controlling it, G. I. Reeves, P. B. Miles, T. R. Chamberlin, S. J. Snow, and L. J. Bower (*U. S. Dept. Agr., Farmers' Bul. 741 (1916), pp. 16, figs. 7*).—A popular summary of knowledge of this insect and means for its control.

Cotton boll weevil control in the Mississippi Delta, with special reference to square picking and weevil picking, B. R. Coad (*U. S. Dept. Agr. Bul. 382 (1916), pp. 12*).—In plat tests of five square pickings at 7-day time intervals an increase of 23 per cent over the check was obtained. Tests of seven weevil pickings with the bag-and-hoop indicated similar results. Comparative observations on different methods of collecting weevils demonstrated the great superiority of the bag-and-hoop over hand picking so definitely that there should be no question as to which method to follow. The margin of profit to be derived from these two control measures seems to be too slight to allow their operation on a wage basis. For this reason the only condition under which they should be attempted is on tenant cotton where the work can be performed without any direct outlay for labor.

House ants: Kinds and methods of control, C. L. Marlatt (*U. S. Dept. Agr., Farmers' Bul. 740 (1916), pp. 12, figs. 5*).—This is a more extended account than that previously noted (E. S. R., 10, p. 654).

FOODS—HUMAN NUTRITION.

The iodin content of foods, E. B. Forbes (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 219, 220*).—The author concludes from his study of the iodin content of various foodstuffs that iodin is a comparatively unusual food constituent, and that its presence is commonly accidental in the sense of standing in no essential relation to the growth of the food products. Variations in the iodin content of foods were not successfully related to any associated conditions. No consistent or orderly geographic distribution of iodin in foods was revealed, nor were there noticeable effects of the type of soil or method of fertilization on the iodin content of foods. The iodin content of samples of the same crop from different plats of the same field sometimes varied greatly.

The relation of certain physical characteristics of the wheat kernel to milling quality, C. H. Bailey (*Jour. Agr. Sci. [England], 7 (1916), No. 4, pp. 432–442*).—The investigations here reported indicate that, with the same type and variety of wheat, kernel volume, because of its relation to the ratio of endosperm to nonendosperm structures, varies directly with the potential flour yield.

"Accurate determination of kernel density must include the complete removal of all mechanically held air. Large kernels, other things being equal, have a higher specific gravity than small kernels of the same variety, indicating the endosperm to have a higher specific gravity than the bran and germ.

"Relative density of the endosperm is generally conceded to be dependent upon the proportion and size of the air vacuoles. Soft, light-colored, yellow-berry kernels have a lower specific gravity than hard, dark-colored kernels of the same variety. The more dense the endosperm, other things being equal, the greater the ease of, and the more complete, the separation of endosperm from bran and germ in milling.

"Wheat kernels of a high specific gravity have a higher nitrogen content as a usual thing than less dense kernels of the same relative size or volume.

"Hard red wheats grown in the northern Great Plains area, while varying widely, have a higher average specific gravity than do the soft red winter wheats grown in the eastern half of the United States."

Milling and baking tests on Argentine and Walla wheats, P. R. Scott and F. G. B. Winslow (*Jour. Dept. Agr. Victoria, 13 (1915), Nos. 11, pp. 661–666, fig. 1; 12, pp. 736–739*).—These tests of wheats imported from Argentina and the Pacific Coast States of this country indicated that, as compared with Australian wheats, the flour produced was lacking in bloom and the dough required a longer time to prove and lacked the power to produce as good loaves. When blended with a moderate percentage of Australian wheat flour, good loaves were obtained.

A method of making bread. G. Cornalba (*Bul. Agr. [Milan], 50 (1916), No. 27, p. 1*).—This article describes a system of bread making which utilizes all of the substance of the grain. The grain is submitted to germination for from 50 to 60 hours, macerated to soften it, ground, mixed with yeast and salt, and then made into a dough. This dough is made homogeneous, divided into loaves weighing about 50 gm., and baked in the usual manner.

The bread is said to have a very dark color, a rough crumb, a heavy crust, and an agreeable and pronounced taste. One hundred kg. of the wheat give about 135 kg. of bread containing about 35 per cent of water, which makes the

weight of the bread a little greater than that of the wheat. It is stated that this system of bread making has the further advantage of utilizing nutritive material which is lost in other methods—e. g., protein, phosphoric acid, lecithin, phytin, organic phosphorus compounds, magnesium salts, and diastatic ferments.

Some factors affecting the cooking of dholl [red gram or pigeon pea] (Cajanus indicus), B. VISWANATH, T. L. ROW, and P. A. R. AYYANGAR (*Mem. Dept. Agr. India, Chem. Ser., 4 (1916), No. 5, pp. 149–163, pl. 1, fig. 1*).—The factors which were studied with reference to their influence upon the rate of cooking of dholl (*C. indicus*) included the composition of the water, the fat content, the variety, and the method of preparation. The results of the investigation are summarized in part as follows:

" Dissolved salts, such as are found in natural waters, exert a marked influence on the time taken to cook dholl. Calcium and magnesium salts and the chlorids of hydrogen and sodium exert a strong retarding effect, whereas alkalis and alkaline carbonates have the reverse action. Whether the action exerted by any salt is a retardation or an acceleration, the effect is approximately proportionate to the concentration, i. e., the harder the water the slower is the rate of cooking. The addition of sodium bicarbonate or sodium carbonate to a hard water materially hastens the cooking.

" The rate of cooking of dholl is approximately proportionate to the rate of solution of the dholl substance—i. e., to the rate of solution of the proteid and starch. The proportion of proteid to starch dissolved is not constant but varies with different solutions. Alkalis and alkaline carbonates dissolve a greater proportion of proteid than starch as compared with pure water, whereas hydrochloric acid dissolves a greater proportion of starch. In addition, alkalis and alkaline carbonates greatly accelerate the rate of cooking.

" The rate of solution of the proteid appears to be the factor which mainly controls the rate of cooking. . . . The fat content plays a very unimportant part. . . . Dholls of different localities have varying rates of cooking."

In connection with the investigation a study was made of the influence of different salts on the liquefaction of pure starch.

Cultivation and canning of mangoes in India, T. C. CHAUDHURI (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 618, 619*).—The author discusses briefly the use of mangoes as food, methods of cultivation, and the problems involved in preserving the fruit.

Case of poisoning by daffodil bulbs (Narcissus pseudo-narcissus), W. G. McNAB (*Pharm. Jour. [London], 4. ser., 42 (1916), No. 2738, pp. 367, 368*).—In this article and its discussion, references are made to several cases of food poisoning caused by eating the bulbs of the common daffodil, these being mistaken for onion and used in the preparation of stews. Severe gastro-intestinal disturbances were experienced but no deaths resulted. It is stated that daffodil bulbs contain an alkaloid whose physiologic action differs according to the stage of growth of the plant.

The investigation of some cases of cheese poisoning, G. SPICA (*Atti R. Ist. Veneto Sci., Let. ed Arti, 69 (1909–10), pt. 2, pp. 685–691*).—Cases of food poisoning attributed to cheese are reported. Four samples of the cheese in question were examined. Extraction with water and ether yielded a substance of unknown chemical composition which was toxic to frogs.

The soy bean and condensed milk in infant feeding, J. RUHRÄH (*Amer. Jour. Med. Sci., 150 (1915), No. 4, pp. 502–512*).—The author reports the results of clinical experience and concluded that the soy bean, condensed milk, and some cereal (as a source of additional carbohydrate) in proper proportions may be used without danger.

On the composition of human milk in Australia.—I, The composition during the early stages of lactation, H. S. H. WARDLAW (*Jour. and Proc. Roy. Soc. N. S. Wales, 49 (1915), pt. 2, pp. 169–198, fig. 1*).—In this extensive investigation a study was made of the composition of 105 samples of human milk obtained during the first 10 or 11 days after childbirth.

In addition to determining the most probable composition of human milk, it was the object of the author to determine the effect of a number of factors upon its composition. It was found that certain values of the percentages of constituents other than fat occurred more frequently than others. These were total solids, 12.8 per cent; solids not fat, 9.8 per cent; protein, 1.9 per cent; solids not fat and not protein, 7.6 per cent. The percentages of fats vary widely, the average content being 3.14 per cent. "The average percentage of fat increased from 2.84 to 4.13 during the first 11 days of suckling; the average percentage of protein decreased from 3.3 to 1.69 during the same period.

"The age of the woman, the number of pregnancies, the volume of the sample, the time since the last withdrawal of milk from the breast, and the breast from which the sample was taken appeared to have no distinct effect on the composition of the milk examined."

A bibliography of cited literature is appended.

Bulletin of the inspection of foods and beverages in Surinam.—Fish Analyses, J. SACK (*Keuringsdienst Eet- en Drinkwaren Suriname, Bul. B (1916), pp. 34*).—Data are given showing the percentage composition of the edible portion and the cost of a number of kinds of fish.

The percentage of alcohol in homemade root beer, C. H. LA WALL (*Amer. Jour. Pharm., 88 (1916), No. 8, pp. 355–358*).—The homemade root beer, prepared according to directions, was found to contain 0.25 per cent of alcohol after standing 2 days and 1.52 per cent after standing 11 days. No higher alcoholic content was observed after the beer had stood for 10 days longer. If the fermenting liquor was allowed to stand 3 hours before bottling and the bottles were only partially filled, the alcoholic content rose more rapidly, and the highest amount noted was 1.77 per cent.

The inhibiting action of certain spices on the growth of micro-organisms, FREDA M. BACHMANN (*Jour. Indus. and Engin. Chem., 8 (1916), No. 7, pp. 620–623, figs. 2*).—The organisms studied in this investigation were pure cultures of species of the common molds, Rhizopus, Penicillium, Aspergillus, and Alternaria (which are frequently found on spoiled preserves), and pure cultures of *Bacillus coli*, *B. prodigiosus*, and *B. subtilis*. The spices tested were added in some form to the nutrient agar in which the bacteria or molds were grown. Studies were made of the effect of alcoholic extracts of spice, ground spice, spice and vinegar, cinnamic aldehyde and eugenol (the active principles of cinnamon and cloves), the oils of allspice and nutmeg, and the oleoresin of black pepper.

The author states that "it does not appear from the extent of the present study that spices as used in the kitchen in the usual amounts for flavoring purposes in spiced cakes exert a very considerable preservative effect. Where cinnamon, cloves, and allspice are used in large amounts, the growth of molds may be retarded. In spiced fruit where a large amount of the spice is used, the preservative effect may be much greater. This effect may be greater, too, when the spice is combined with vinegar."

It is suggested that cinnamic aldehyde and possibly other active principles might be used in such proportions as to prevent the growth of micro-organisms and yet in small enough quantities not to spoil the flavor of the product.

"Pepper and nutmeg have little effect on the growth of micro-organisms. A mixture of nutmeg and water boiled for a half hour and left exposed to the air for chance inoculation was covered with various molds in less than a week. Cloves and allspice in large amounts are quite effective in preventing the growth of molds and bacteria, and cinnamon is the most effective of the spices; this is true of the ground spices, their essential oils, and the alcoholic extracts."

The dairy and pure food laws of the State of Connecticut (*[Hartford, Conn.]: Office Dairy and Food Comr. [1916], pp. 52*).—The text of the laws is given as corrected to the close of the legislative session of 1915.

[Food and drug analyses], J. P. STREET ET AL. (*Connecticut State Sta. Rpt. 1915, pt. 5, pp. 265–419*).—This report presents the results of the analysis of 2,220 samples of foods and drugs, of which 1,081 were not adulterated. The food products examined included cereal breakfast foods, cheese, cocoa and chocolate preparations, coffee, coffe substitutes, diabetic foods, fig preparations, flavoring extracts, canned fruits, infant foods, sirups, etc. Full analytical data are given regarding each of the samples analyzed. The drug products examined included standard drug preparations and proprietary medicines.

Bulletin of the inspection of foods and beverages in Surinam.—Analyses of common foods, J. SACK (*Keuringsdienst Eet- en Drinkwaren Suriname, Bul. C (1916), pp. 12*).—In this bulletin analytical data are reported concerning the composition of some well-known meats, vegetables, and fruits.

Rates for electric cooking and water heating (*Jour. Electricity, 37 (1916), No. 1, pp. 12, 13*).—The question of proper rates for this class of service is discussed and the rates of several western companies are given as illustrations.

Canning in glass in the home (fruits, vegetables, and meats), SARAH E. BELT (*Agr. of Mass., 63 (1915), pt. 2, pp. 49–57*).—General information and specific directions are given for the canning of fruits, vegetables, and meats.

Interim report of the departmental committee appointed by the president of the board of agriculture and fisheries to consider the production of food in England and Wales, MILNER ET AL. (*London: Govt., 1915, pp. 7*).—A number of measures are recommended for increasing the present production of food, on the assumption that the war may be prolonged beyond the harvest of 1916.

Food economics, G. LUSK (*Jour. Wash. Acad. Sci., 6 (1916), No. 12, pp. 387–396*).—This lecture presents statistical data showing the amount of protein and the fuel value of food consumed by people living under extremely varied conditions.

It also includes a brief statement of the results of a dietary study by F. C. Gephart, carried out at a private boarding school for boys having 355 students, in which determinations were made of the food supplied per meal, the proportion of the total number of calories furnished by the different foods, the cost of the food, and the amount of waste. The author states that the growing athletic boys in this school were not satisfied with 3,000 calories daily, but took 4,350 calories daily at the table and also bought 650 additional calories at a neighboring store. In his opinion these results show that active boys eat more food than is realized and that their ravenous appetite is due to the muscular work involved in their play and that "lack of appreciation of this factor and lack of provision for it are the probable causes of much of the undernutrition seen in children of the school age."

The importance is emphasized of including on the label a statement of the number of calories furnished by packages of foods.

Conditions of diet and nutrition in the internment camp at Ruhleben, A. E. Taylor (*London: Govt., 1916, pp. 12*).—The data presented in this report are based on a 7-day study of the dietary in the camp.

The following requirements are given for a complete, sufficient, and normal diet: "It must contain protein sufficient in amount and representative in component amino acids to maintain the tissues and cells of the body in a state of normal composition and function. . . . It may be stated that from 70 to 90 gm. of protein per day are fully competent to maintain normal nutrition in the adult male (not engaged in hard work), provided that the proteins offer the body all the needed amino acids and that the diet is rich in carbohydrate."

The diet should also contain a sufficient amount of fuel (largely in the form of carbohydrate) to furnish at least 30 calories per kilogram of body weight per day. It must contain from 25 to 50 gm. of fat per person per day, the various salts required in the body, and certain unknown substances grouped under the term "vitamins," and it should not consist entirely of preserved or conserved foodstuffs.

In addition, the author lays considerable emphasis on the fact that the diet to be entirely adequate must take into some account the habits, tastes, and customs of the persons fed. It is pointed out that diets tolerated under normal conditions may become intolerable under conditions of confinement and that monotony of the diet should be avoided, since it may lead to reduced appetite and consequently impaired nutrition. Monotony of the diet is less noticeable if it is one to which the individual has been accustomed.

As a result of this investigation a number of changes in the diet of the camp are recommended and embodied in this report.

Review of the literature on the metabolism of normal infants, W. McK. Marriott (*Amer. Jour. Diseases Children, 12 (1916), No. 1, pp. 88–102*).—In this summary and digest of data the results obtained by a number of investigators on different phases of this subject are brought together. Most of the material has been previously noted from the original sources.

The question of cellulose digestion, W. Ellenberger (*Hoppe-Seyler's Ztschr. Physiol. Chem., 96 (1915), No. 3, pp. 236–254*).—A preliminary note discussing the factors which influence cellulose digestion.

The antiseptic action of the gastric juice, J. P. Gregersen (*Centbl. Bakt. [etc.], 1. Abt., Orig., 77 (1916), No. 4, pp. 353–361*).—The object of these experiments was to determine the influence of the acidity of the gastric juice upon its bactericidal action and whether or not any other factors were involved. Samples of the gastric contents were obtained from a number of individuals 45 minutes after the ingestion of an Ewald test meal (35 gm. of toast and 250 gm. of water), the acidity of the contents measured by titration, and the bactericidal property determined, *Staphylococcus pyogenes aureus* being the organism used. In some of the samples different degrees of acidity were secured by the addition of hydrochloric acid or sodium hydroxid before determining the bactericidal property.

It was found that the bactericidal power of the stomach contents varied directly as the amount of free acid present and was not influenced by the combined acidity or the amount of pepsin present. The bactericidal action of the gastric juice was from 3 to 4 times as strong as corresponding strengths of the pure acid in water.

The presence and significance of molds in the alimentary canal of man and higher animals, G. Turesson (*Svensk Bot. Tidskr., 10 (1916), No. 1, pp. 1–27*).—This article reports the results of the isolation and investigation of molds in samples of feces from 13 different persons, two of whom were vegetarians. In addition to determining the species present investigations were

made of the action of temperature and gastric juice upon the spores of Penicillium and Aspergillus and the pathogenic properties of molds isolated from human and animal feces by means of intravenous injections and feeding experiments made on laboratory animals.

In summarizing the results of the investigation, the author states in part that "the occurrence of fungi in the alimentary canal of man has been proved to be more frequent than was formerly supposed. In analyzing samples of human feces the following molds were isolated: *A. fumigatus, A. flavus, A. niger, A. nidulans, A. umbrinus, A. terreus, P. divaricatum, Oïdium lactis.* In addition numerous yeasts were found. . . .

"The temperature modifies the toxic action of the gastric juice in this way: An increase in temperature above the optimum for the fungus increases the toxicity of the juice to the species. Molds with low optima are, therefore, killed when passing through the alimentary canal, while thermophilous species pass through alive. Accordingly, only molds with comparatively higher optima are found in feces of warm-blooded animals while feces of cold-blooded animals yield molds with low optima as well.

"Intravenous injections in rabbits of *A. terreus, A. umbrinus*, and *P. divaricatum* showed no pathogenic properties of these molds.

"Feeding of spores and mycelium of *A. fumigatus, A. flavus, A. niger, A. nidulans, A. umbrinus, A. terreus, P. avellaneum*, and *P. divaricatum* to rabbits proved to be fatal. The symptoms of poisoning from the toxic molds were muscular convulsions resembling tetanus, weakness, and paralysis, followed by death.

"An accumulation of molds in the alimentary canal of man may lead to serious disturbances and should, therefore, receive due attention."

A bibliography of cited literature is appended.

Chemical changes in the central nervous system as a result of restricted vegetable diet, MATHILDE L. KOCH and C. VOEGTLIN (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 103 (1916), pp. 5–49, figs. 12*).—The small amount of experimental data available regarding the chemical changes produced in the central nervous system as the result of changes in diet shows that underfeeding with a mixed diet leads to no marked changes except a high variation in the water content, that starvation does not appear to change the composition of the brain, and that an exclusive diet of polished rice leads to a decrease in the amount of nitrogen and phosphorus in the brains of pigeons.

In this investigation six laboratory animals (monkeys) were fed upon the following diets: (a) Corn-oil cake, a substance poor in vitamin; (b) equal parts of corn meal and sweet potatoes, a diet rich in carbohydrates and poor in protein and fat; (c) corn meal; and (d) raw carrots. From a comparison of the chemical composition of the encephalon and spinal cord of these six monkeys with the composition of the encephalon and spinal cord of a normal monkey maintained on a mixed diet as a control, the following conclusions are drawn:

"Chemical changes in the brain and cord are observed in animals (monkeys and rats) as the result of an exclusive vegetable diet of various composition.

Histological examination of the central nervous system of these animals reveals extensive degeneration of many nerve tracts in the spinal cord, very similar to those found in pellagra.

In some of the animals the chemical changes are practically identical with the changes observed in pellagra. These findings therefore yield additional evidence for the theory that pellagra is a dietary disease."

Chemical changes in the central nervous systems in pellagra, MATHILDE L. KOCH and C. VOEGTLIN (*Pub. Health Serv. U. S., Hyg. Lab. Bul. 103 (1916),*

pp. 51–129. pls. 2, figs. 3).—In this report the work of other investigators on the subject is briefly reviewed, and a short summary of the present-day knowledge of the chemical constituents of the nervous system is given. The analytical methods employed are described in detail. A comparison of the chemical analysis of the central nervous system in five cases of uncomplicated pellagra, as compared with the chemical analysis of normal controls, showed that in pellagra the central nervous system is subject to a series of chemical changes involving, principally, certain lipoids.

ANIMAL PRODUCTION.

The production coefficients of feeds, G. S. Fraps (*Texas Sta. Bul. 185 (1916), pp. 5–16*).—It is stated that the value of a feeding stuff consists in its volume, which satisfies the appetite of the animal, its digestible protein, which furnishes material for muscular and other similar tissue, and its productive value, which represents its value for the purpose of supplying energy for work, or bodily activities, heat, or material for the production of fat, etc. This bulletin describes a method of calculating the productive values of feeds from their chemical composition.

The productive value of a feed is defined as the amount of fat that the feed will produce upon a fattening animal, when it is fed in addition to a basal ration already sufficient for the bodily needs of the animal. The author prefers to express the productive value in terms of fat for the reason that it represents as nearly as is possible the exact substance measured in the experiments, and does not involve any assumption as to the quantity of productive energy consumed in forming fat, or other similar assumptions. Knowing the composition and coefficients of digestibility the productive value in terms of fat of a given feeding stuff may be calculated, but in order to simplify the calculation it is proposed to use a factor to be known as the production coefficient. This is defined as the factor which, multiplied by the percentage of the nutrient, gives the productive value of that nutrient in terms of fat.

As the production coefficient is calculated from the coefficient of digestibility, anything that will affect the digestion will also affect the production coefficient. Also, some feeds may be regarded as mixtures of two or more constituents which have different coefficients of digestibility and different production values. Cotton-seed meal, for example, may be considered as composed of cotton-seed kernel residue and cotton-seed hulls, and the amount of cotton-seed hulls may be calculated from the amount of crude fiber present. Since cotton-seed kernels and cotton-seed hulls have different production coefficients, the quantity of crude fiber will thus affect the production coefficient of the feeding stuff.

There are similar variations in the composition of other feeding stuffs which are related to different constituents having different digestive coefficients and different productive values. These are problems which are under study.

A table is given which shows the production coefficients of a number of feeds, based upon the average coefficients of digestibility. A column is included which shows the method of correction used for the crude fiber, or nitrogen-free extract, or both, as the case may be.

[Feeding stuffs], F. A. Clowes (*Hawaii Sta. Rpt. 1915, pp. 51–53*).—Honohono (*Commelina nudiflora*) is described as an extremely succulent feed, much relished by cattle. Cattle fatten and produce an abundance of milk when pastured where it is plentiful. The total yield of green feed per acre, calculated from an experimental plat 10 ft. square, was 223.6 tons. Per acre production it compares very favorably with green alfalfa both in protein and in other food constituents.

It is stated that as a pasture grass *Paspalum dilatatum* has given excellent results. Its strong deep root system enables it to withstand the tramping of stock in wet weather better than any other grass tested that is equally relished by the cattle.

Cane-top silage has proved of value in feeding operations. Some of the cane tops were cut two weeks before they were put into the silo. Notwithstanding the resulting staleness and the excessive amounts of water that went into the silo during filling, the silage was of fair quality and was eaten readily by the cattle and horses. The yield of cane tops per acre is about 10 per cent of the weight of the usable cane, and on the unirrigated plantations this by-product would run from 4 to 8 tons of cane tops per acre.

Commercial feeding stuffs, 1915, J. P. STREET ET AL. (*Connecticut State Sta. Rpt. 1915, pt. 4, pp. 233–264*).—Analyses are given of the following feeding stuffs: Cotton-seed meal; linseed meal; wheat bran, middlings, and shorts; cracked corn meal; corn gluten meal; corn gluten feed; hominy feed, dried brewers' grains; dried distillers' grains; dried beet pulp; mangels; coconut meal; peanut meal; oats; provender; alfalfa; alfalfa meal; cracker wastes; and various mixed and proprietary feeds.

Facts for the feed buyer, W. H. STROWD (*Wisconsin Sta. Bul. 267 (1916), pp. 56*).—Information regarding feeding stuffs is summarized, and analyses are given of the following: Cotton-seed meal, linseed meal, gluten feeds, corn oil meal, distillers' grains, hominy feed, corn germ meal, wheat bran and middlings, red dog flour, germ middlings, oatmeal and rye middlings, barley shorts, buckwheat bran, malt sprouts, dried brewers' grains, dried malt grains, alfalfa meal, blood and meat meal, meat scrap, bone products, tankage, ground peas, flax shives, silage, soy bean hay, and various mixed and proprietary feeds.

[Nutrition investigations at the Wisconsin Station] (*Wisconsin Sta. Bul. 268 (1916), pp. 36–42, figs. 2*).—Notes on several studies are given.

Value of proteins from different sources [for growth], by E. V. McCollum.—Since various unbalanced proteins are not all deficient in the same amino acids, it might be expected that when two unbalanced proteins were combined the first might supplement the deficiencies of the second and better growth be made than with either alone. To study this problem young pigs were fed on many rations in which either a single feed or two or more feeds mixed in various proportions supplied the protein.

Of those tested the proteins of milk were found most efficient for growth, the pigs storing in their bodies over 60 per cent of the milk protein. The proteins of the cereal grains had an efficiency of only from 23 to 28 per cent, and of linseed meal, fed alone, only 18 per cent. However, when three-fourths of the protein in the ration came from the corn and one-fourth from linseed meal the efficiency was increased to 37 per cent. From this it is concluded that linseed meal and corn are not deficient in the same amino acids, and that when combined one tends to correct the deficiencies of the other. This agrees with the good results secured in numerous scientific trials and in practice when linseed meal is fed as a supplement to corn. On the other hand, no better results were secured when wheat and wheat embryo were combined than when each was fed separately. In this case each feed is evidently deficient in the same amino acids, and one can not supplement the other.

Value of proteins from different sources [for milk production], by E. B. Hart and G. C. Humphrey.—It has been found in metabolism experiments with dairy cows that proteins from various sources are likewise of different worth for milk production. In these trials cows were fed a basal ration of corn stover, which supplied but a small amount of digestible protein. To this ration were added

corn grain and corn by-products, or wheat grain and by-products (much of the protein of which is unbalanced in composition), or milk protein, supplied in the form of skim-milk powder and casein (furnishing proteins which are well balanced in composition).

The percentage of the digestible protein of these rations which was used by the cows for milk production and the formation of body protein was 40 per cent with the corn ration, 34 per cent with the wheat ration, and 58 per cent with the milk protein ration. Such complete proteins as are furnished by milk are thus apparently of high efficiency for milk production.

Commonly unappreciated factors in food, by E. V. McCollum.—Previous experiments (E. S. R., 31, p. 864) have demonstrated that certain fat-soluble substances found in milk fat, fats from egg yolk, corn grain, and wheat embryo, and the soft portion of beef fats are necessary in the diet for continued growth. It appears that there is also required another class of substances which are soluble in water, the nature of which has not been discovered. These substances have been found thus far in egg yolk and wheat embryo, and are probably present in corn. Growing rats fed a ration of highly purified casein, egg albumin, dextrin, mineral matter, and milk fat failed to grow. However, normal growth took place when the water extract of wheat embryo was added, which evidently supplied the necessary accessory to the diet. It has been found that neither the fat-soluble nor the water-soluble accessories are injured by heating above the boiling point of water.

Influence of strictly vegetable diets on growth and reproduction, by E. B. Hart and E. V. McCollum.—It is thought that strictly vegetable foods might be found insufficient for normal growth. To study this problem experiments were carried on with growing pigs kept in pens away from the soil and supplied in some cases with distilled and in others with natural water. On a well-balanced concentrate mixture of oats, corn, wheat, and oil meal, pigs failed to grow after about three months, even when sugar beets and alfalfa hay were supplied two or three times a week. Where but 1 per cent of meat scrap was added to the ration the pigs grew normally, reaching a weight of 250 lbs. by the time those on the strictly vegetable diet had reached 100 lbs.

Other experiments, however, showed that the missing essential constituents could be supplied in vegetable feed. In the earlier experiments uncut alfalfa hay was offered the pigs, but they consumed very little. Fifteen per cent of finely ground alfalfa meal was then mixed with the ration, so that the pigs would be forced to consume larger amounts of alfalfa. On this vegetable ration good growth occurred. These experiments indicate that the meat supplied a better-balanced protein mixture than the basal ration of grains and oil meal, and also more of the diet accessories needed for rapid growth. These accessories are also apparently present in alfalfa.

Corn silage for beef cattle, by J. L. Tormey.—In six trials, each of which lasted 90 days, a total of 63 2-year-old steers were fed. In these trials the addition of silage to rations of concentrates and either alfalfa or clover hay decreased the amounts of concentrates required per pound gain, but increased the roughage requirement. In all cases the addition of the silage lessened the feed cost per pound of gain and reduced the necessary margin, although a heavy concentrate allowance with less silage produced more rapid gains. For fattening 2-year-old steers an average daily ration throughout the feeding period of 20 lbs. of corn silage, 5 lbs. of clover, alfalfa, or mixed hay, 12 lbs. of shelled corn, and 2 lbs. of cotton-seed meal, or amounts of other protein-rich concentrates furnishing an equal amount of digestible protein, is recommended.

In one of the trials steers fed an average ration of 37.6 lbs. silage, 3.1 lbs. clover hay, and only 7 lbs. concentrates (3.1 lbs. corn, 2.7 lbs. cotton-seed meal

and 1.2 lbs. wheat bran) per head daily gained 2.36 lbs. per head daily. A lot fed 13.5 lbs. concentrates (9 lbs. corn, 2 lbs. cotton-seed meal, and 2.5 lbs. wheat bran), with 28.8 lbs. silage and 3.2 lbs. clover hay, gained 2.59 lbs. per head daily. However, the feed cost of the gains of these steers fed the heavier concentrate allowance was 16 per cent higher and the margin necessary in feeding was 31 cts. greater.

Studies in animal breeding (*Wisconsin Sta. Bul. 268 (1916), pp. 9, 10*).—Studies on the effect of such poisons as lead on the germ cells of the male showed the same deleterious results as were obtained the year before (E. S. R., 33, p. 368).

Work on the inheritance of epilepsy in guinea pigs has shown that this disease is inheritable and follows Mendel's law.

In a study, carried on by H. L. Ibsen, of the growth of guinea pigs in embryo and after birth it has been observed that the weights of the different embryos in a litter show that the first and last embryos are invariably larger than those in the middle of the same horn of the uterus. It is popularly believed that the "titman" or runt of a litter of pigs is the last one to be born, but this observation would seem to indicate that such is not the case, as the smaller embryos are always found in the middle of the row of young in the uterus.

In experimental work on the influence of close inbreeding, carried on by J. G. Halpin, it is reported that with Rhode Island Reds results of a detrimental character are beginning to be observed, that the closely inbred stock takes longer to hatch and frequently does not produce so strong chicks as those from the control pens.

The influence of sires on production, C. C. HAYDEN (*Mo. Bul. Ohio Sta., 1 (1916), No. 7, pp. 211–215, figs. 2*).—Partial records were kept of the results of the use of various bulls in the station dairy herd. The first bull used on the first group of cows came from a dam which had a good official record, and the granddam on the sire's side had a record of large production. His sire was more noted as a show-ring favorite than as a sire of producing daughters. The results showed an average gain of the daughters over their dams of 1,902 lbs. of milk and 60 lbs. of fat for the first year, and an average yearly difference of 1,176 lbs. of milk and 42 lbs. of fat for all periods.

A second bull was selected for this group, the price paid being about twice that for the first bull. He had better records of production back of him, and the results justified the greater expenditure. The gain over the original dams by the use of this bull was for the first calf 4,074 lbs. of milk and 156 lbs. of fat, and for one year of all lactation periods, 4,207 lbs. of milk and 153 lbs. of fat. The gain over the daughters of the previous bull was for the first year only 2,172 lbs. of milk and 96 lbs. of fat, and for one year of each lactation period, 3,031 lbs. of milk and 111 lbs. of fat.

The first bull used on the second group was selected from one of the best herds in Ohio, though his sire and dam had no official records. A decrease of 687 lbs. of milk and 39 lbs. of fat showed that the use of this sire greatly reduced the productive capacity. His double daughters produced 3,520 lbs. of milk and 202 lbs. of fat, or a decrease of 521 lbs. of milk and 32 lbs. of fat below their dams.

The daughters of a second bull used on this group show an increase over the daughters of the first bull of 752 lbs. of milk and 32 lbs. of fat per year. For the first lactation period only they show an increase of 1,205 lbs. of milk and 49 lbs. of fat, indicating that they will be far superior to the daughters of the first bull when they are mature. At the time this second bull was purchased his ancestry had no official records, but his dam was said to be a heavy persistent milker and his sire was imported.

Sheep-breeding investigations, R. H. WILLIAMS and W. S. CUNNINGHAM (*Arizona Sta. Rpt. 1915, pp. 554–560*).—In continuation of work previously noted (E. S. R., 33, p. 73), it is reported that the Tunis sheep continued to prove themselves vigorous breeders and produce early active lambs with a marked ability to withstand heat. Their greatest fault is that the wool is very coarse, with loose crimp and too much hair, or "kemp."

Hampshire, Shropshire, Oxford, and Dorset breeds have been used to improve the mutton characteristics of the lambs, and have proved valuable for this purpose in the order named. Oxford and Dorset breeds have been eliminated because of the high rate of mortality among the lambs. More recently it has been decided to limit the Shropshire blood because of the smaller size, inferior mutton form, and lower percentage of black faces in their lambs than in those of the Hampshire crosses. Unfortunately, the Hampshire crosses are inferior in wool, having a short staple and light fleeces. The weight and quality of wool of the native sheep, which are of Merino foundation, have not been much improved by the above process.

It is thought that the ideal valley sheep must have a somewhat open fleece, while the range sheep may have a denser and longer fleece, due to their grazing in higher altitudes.

Of the breeds used the Tunis and Hampshire have brought about the greatest improvement. Lambs showing a high proportion of Tunis blood have been active, alert, and hardy, but have given poor quality of wool and are of only fair mutton conformation. The Tunis-native cross has usually resulted in tan-colored face and legs, although many mottled and white faces are found. The wool from this cross is usually of medium staple, good length, and density, but contains too much kemp. The Hampshire blood has been excellent in improving the mutton form, increasing the size, and stamping black faces on their crosses. A table is given showing the weights at different ages and the average weights of fleece for the more desirable crosses.

Data kept for three years indicate that lambs born early in the year usually reach a greater weight at six months than those dropped later. The average weight of lambs born in January was greater than that of any other month; February lambs more than March; March lambs more than April, and April lambs more than May. There was difference of 17.21 lbs. between the average weight of May lambs and those born in February. There is a general tendency for the earliest lambs to reach a larger average weight, due to the fact that there are few or no small lambs.

There has been found to be a great difference in the fineness and denseness of the wool fibers in the various crosses, and certain crosses have been more efficient than others in eliminating the characteristic Tunis hair, or kemp, from the wool. The Hampshire and Shropshire blood have aided materially in improving this fault, the former being of the greatest service.

In this study it has been noted that there is a close correlation between the fineness and the denseness of wool. In every case where a fleece is reasonably fine it is also fairly dense.

Maintenance rations for breeding flocks of mutton and wool sheep, B. O. SEVERSON (*Pennsylvania Sta. Rpt. 1914, pp. 84–117*).—Continuing previous work (E. S. R., 34, p. 171), the four lots of ewes were fed during the 216 days beginning April 19. During the summer months all of the breeding ewes with their lambs were placed on the same pasture. The lambs were allowed to suckle their dams until 16 weeks of age, and during this time they were allowed to consume as much grain as they would eat. After weaning, the ewes were placed on another pasture with no grain and the lambs were continued on

the same pasture and fed a grain ration consisting of shelled corn, oats, wheat bran, and linseed meal, 5:3:2:1. From September 12 to November 5, 978 lbs. of the same grain mixture was fed the 38 ewes.

The average weights of the ewes during the summer months were greater for the two lots of sheep (lots 1 and 3) in which silage had been fed as the sole roughage during the preceding winter. During the entire period the average increase in weight of each ewe in lot 1 was 28.946 lbs., in lot 2, 32.138 lbs., in lot 3, 13.752 lbs., and in lot 4, 15.307 lbs. The Shropshire ewes (lots 1 and 2) thus gained practically twice as much as the Delaine-Merino ewes (lots 3 and 4). It is estimated that the average cost of keeping each ewe during the 216 days was $2 per head, no credit being given for the value of manure produced while on pasture or the improvement that the sheep brought about by destroying the weeds.

From April 19 to August 9, the Shropshire lambs (lots 1 and 2) made average daily gains per head of 0.573 and 0.484 lb., while the Delaine-Merino lambs (lots 3 and 4) made average daily gains of 0.288 and 0.36 lb. per head. The total cost of feed was $5.52 for 25 lambs for a period of 112 days.

During a second winter period of 154 days four lots of 10 ewes each were fed. Lots 1 and 3, consisting respectively of Shropshire and Delaine-Merino ewes of breeding age, were fed a roughage ration composed of corn silage supplemented with cotton-seed meal, and a grain mixture composed of shelled corn, oats, bran, and linseed meal, 5:3:2:1, this mixture being fed at such times and in such amounts as were sufficient to keep the ewes in good breeding condition. Lots 2 and 4, Shropshire ewes and Delaine-Merino, respectively, were fed a roughage ration composed of corn silage and alfalfa hay, together with a grain ration as in lots 1 and 3.

During the first four weeks all lots made good gains. The second period of four weeks gave good gains to lots 2 and 4, but only 0.366 lb. per head in lot 1 and a loss of 0.5 lb. per head in lot 3. All lots lost weight during the third four-week period. Comparing lots 1 and 2, the average weight during the winter was greatest in lot 2. The same correlation in average weight existed in lots 3 and 4. These results are the reverse of those secured during the first winter's investigation (E. S. R., 34, p. 171). During the winter period the average loss per ewe in lot 1 was 20.044 lbs. and 5.209 lbs. in lot 2. The Delaine-Merino ewe gained in weight during the winter, lot 3 gaining 1,953 lbs. per head, and lot 4, 17.431 lbs.

The average amount of air-dry matter consumed per head by the Shropshire ewes maintained on corn silage as a sole roughage was 1.922 lbs., while lot 2 averaged 2.651 lbs., lot 3, 1.655 lbs., and lot 4, 2.336 lbs. Comparing the Shropshires in lot 1 with the Delaine-Merino in lot 3, the latter consumed 0.267 lb. less per head and 0.197 lb. more per 100 lbs. live weight during the winter. The Delaine-Merino ewes in lot 4 consumed 0.335 lb. of air-dry matter more per 100 lbs. live weight and 0.315 lb. less per head than the Shropshire ewes of lot 2. The daily cost of maintaining the breeding ewe was 1.522 cts. in lot 1, 2.248 cts. in lot 2, 1.317 cts. in lot 3, and 1.851 cts. in lot 4. The amount of wool produced was slightly greater in lots 1 and 3 than in lots 2 and 4. No effect of the ration fed could be detected from the market classification.

The Shropshire ewes in lot 1 that yeaned averaged 3.5 lbs. less in weight than those of lot 2. Their lambs averaged 0.9 lb. more per head than those of lot 2, but the mortality of both ewes and lambs was greater in lot 1, indicating that the ration possessing corn silage as a sole roughage for Shropshire ewes did not prove satisfactory in this experiment. The pregnant Delaine-Merino ewes in lot 3 averaged in weight 9.6 lbs. less than the ewes of lot 4

that yeaned. The lambs also averaged less in weight at birth in lot 3 than in lot 4, were less active, and had a greater mortality.

A comparison of the Shropshires with the Delaine-Merinos showed their respective average weight to have been 150.5 and 102.9 lbs. At birth the Shropshire lambs average 7.93 lbs. per head and the Delaine-Merino lambs 6.89 lbs. The Shropshire ram lambs averaged 8.27 lbs. and the ewe lambs, 7.28 lbs., while the Delaine-Merino ram lambs averaged 7.1 lbs. and the ewe lambs, 6.64 lbs.

The Shropshire ewes averaged 141.6 lbs. per head at the end of four weeks, after yeaning, a loss of 10.9 lbs. per head. The Delaine-Merino ewes averaged 104 lbs. per head, an average loss of 1.4 lbs. per head during this period. The Shropshire lambs averaged 21.5 lbs. at the end of four weeks, an average gain of 13 lbs. per head, while the Delaine-Merino lambs averaged 20.4 lbs. per head, an average gain of 12.9 lbs. per head. Comparing lots 1 and 3 with lots 2 and 4, respectively, practically the same gains in live weight of lambs were made.

In summarizing, it is concluded that the two winter periods show that a ration composed of corn silage as a sole roughage supplemented with cotton-seed meal for every 25 lbs. of corn silage fed is unsatisfactory for pregnant ewes, even when supplemented by a good grain mixture. Lambs dropped by ewes of the mutton and wool types, fed a ration composed of corn silage supplemented by cotton-seed meal, as compared with ewes of the same types fed a roughage ration composed of corn silage and alfalfa hay, are heavier, weaker, less active at birth, and have a greater mortality. Breeding ewes fed a ration composed of corn silage supplemented by cotton-seed meal were less active and showed lower vitality during the latter stages of pregnancy than ewes fed corn silage and alfalfa hay as roughages. Lambs raised by breeding ewes of both breeds fed corn silage as a sole roughage and cotton-seed meal as a supplement made satisfactory gains and matured into good vigorous lambs. Corn silage and alfalfa hay proved to be a satisfactory roughage when supplemented by a grain mixture composed of shelled corn, oats, wheat bran, and linseed meal, 5 : 3 : 2 : 1, for maintaining pregnant ewes in vigorous condition for yeaning. The cost of feeds consumed by lot 1 during the winter of 1911-12 was $3.19 per ewe, and in 1912-13, $2.38; for lot 2 during the winter of 1911-12 $4.11 per ewe, and in 1912-13, $3.46; for lot 3 during the winter of 1911-12, $2.74, and in 1912-13, $2.03; and for lot 4 during the winter of 1911-12, $3.78, and in 912-13, $2.85. The value of fleeces per head was $1.767 in 1912 and $1.968 in 1913 for lot 1; $1.591 in 1912 and $2.025 in 1913 for lot 2; $3.02 in 1912 and $2.882 in 1913 for lot 3; and $2.731 in 1912 and $2.795 in 1913 for lot 4.

The cost of maintaining Shropshire breeding ewes was greater than the cost of maintaining Delaine-Merino ewes, and slightly greater on a live-weight basis. Delaine-Merino lambs made less rapid gains than Shropshire lambs. Delaine-Merino ewes were observed to be more easily afflicted by "foul foot," due to damp weather, than Shropshire ewes. Wintering pregnant ewes in an open shed was conducive to the health and thrift of the ewes and lambs. Such quarters, however, should have a southern exposure, a dry bed, and a well-drained and spacious yard.

Hog and sheep pasturing demonstrations, R. W. Allen (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 27, 28*).—Thirteen head of 73.5-lb. pigs were put on a 3-acre tract of clover in the spring. Without supplementary feed, 0.57 lb. per hog per day was made for 31 days. During the succeeding 30 days they were also fed rolled barley at the rate of 0.5 lb. per hog per day, and an aver-

age daily gain of 0.44 lb. per hog was made. During the 56 succeeding days the animals were run on the same clover, and in addition pastured off 4 acres of field peas grown in an adjoining tract. On this ration they made an average daily gain of 0.77 lb. per hog.

It is estimated that for the entire period $11.35 per acre was realized from the clover, and $6.80 per acre from the peas for a 52-day period. In addition to these pigs 20 head of small pigs were also run on both the clover and pea pasture.

For the purpose of determining the amount of gain that sheep will make and with what degree of success they can be kept in bearing orchards, 8 ewes with their lambs were kept on 1 acre of clover that had reached an average height of 10 in. for three weeks and fed it down closely. The following two weeks they fed down an additional acre, the decrease in time necessary being principally due to the greater amount of forage consumed by the lambs. During 52 days the lambs gained 63.2 lbs. each, and the ewes 3 lbs. each, making a total gain of 534 lbs. for the 16 head. From the amount of forage consumed by these animals it appears that 16 head of sheep, half of which are mature, can be carried on 3 acres of clover in bearing orchards.

Dry lot versus pasture crops for growing and fattening pigs for market, W. H. TOMHAVE and H. H. HAVNER (*Pennsylvania Sta. Rpt. 1914, pp. 122–128, pls. 5*).—Four 1-acre plats were sown for a rotation of pasture crops consisting of oats and Canadian field peas; field corn drilled; and rape. A lot of 19 9-week-old pigs was pastured on these plats and a similar lot pastured on a dry lot of ½ acre. The pigs on the dry lot were fed a ration of corn meal and tankage 8:1, and those on pasture corn meal and takage 12:1.

The pigs on forage-crop pasture made larger and more economical gains than those in the dry lot. The cost of grain per pound of gain varied from 4.72 to 5.96 cts. in the pasture lot, and from 6.08 to 7.6 cts. in the dry lot. The rate of gain varied from 0.804 to 1.57 lbs. per pig daily in the pasture lot, and from 0.724 to 1.378 lbs. in the dry lot, due to the two systems of management. The pigs on pasture had a higher degree of finish and were more thrifty than those in the dry lot. The use of a rotation of pasture crops proved more profitable than dry-lot feeding.

[Feeding experiments with hogs], W. H. TOMHAVE (*Pennsylvania Sta. Rpt. 1914, p. 82*).—In an experiment to determine the value of pasture for growing pigs as compared to dry-lot feeding two lots of weanling pigs were fed as follows: Lot 1, a grain ration of corn meal and tankage, 12:1, in addition to pasture; lot 2, corn meal and tankage, 8:1. The pigs on the pasture made greater daily gains at smaller expense than did those in the dry lot, and they also showed greater thrift.

In a second experiment one lot of 10 shotes was fattened in a dry lot and fed ear corn and 0.25 lb. of tankage. Another lot was given access to standing field corn, and in addition received 0.25 lb. of tankage per head daily. The pigs made an average daily gain of 1.45 and 1.74 lbs. per head, respectively, gaining 11.6 and 12.3 lbs. per bushel of corn consumed, and returning 86.2 and 93.5 cts. per bushel of corn consumed.

Fattening pigs for market, W. H. TOMHAVE and H. H. HAVNER (*Pennsylvania Sta. Rpt. 1914, pp. 117–121, pls. 5*).—Four lots of three 138-lb. pigs each were fed for 84 days as follows: Lot 1, corn meal and tankage, 10:1; lot 2, shelled corn and tankage, 10.1; lot 3, buttermilk and corn meal, 1:1, and lot 4, wheat middlings and corn meal, 1:1. These lots made average daily gains of 1.723, 1.567, 1.82, and 1,146 lbs. per head, consuming 3.746, 4.025, 3.367, and 4.7 lbs. of concentrates per pound of gain, costing 1.559, 1.415, 1.5, and 1.424 cts. per

pound of feed consumed, and realizing a total profit per lot of $14.15, $13.44, $15.50, and $6.94 for the respective lots.

Feeding and management of hogs, J. I. THOMPSON (*California Sta. Circ. 151 (1916), pp. 16, fig. 1*).—This circular treats of the breeding, feeding, care, and management of hogs under California conditions, and of the butchering, curing, and keeping of pork.

Hens confined as compared with hens having access to open yard, M. C. KILPATRICK and D. E. WARNER (*Pennsylvania Sta. Rpt. 1914, pp. 121, 122*).—In an experiment to determine the relation between the number of eggs laid, the amount of feed consumed, and the physical condition of each flock, two lots of 40 White Leghorn hens each were fed, lot 1 being confined and lot 2 having the use of a yard.

At the end of the first 13 weeks the fowls in pen 2 had laid 466 eggs, whereas those in pen 1 had laid only 179. During the second 13 weeks pen 2 laid 1,285 eggs and pen 1, 1,221. During the third 13 weeks pen 2 laid 2,079 eggs and pen 1, 1,589. During the last 13 weeks pen 2 laid 1,525 eggs and pen 1, 1,483.

It is concluded that in order to obtain the best results in egg production it is a decided advantage to allow the flock of hens the use of a yard where they may have room to exercise and secure green feed at certain seasons of the year. There seemed to be, however, a period, from about January to April, when the egg yield from both pens ran about parallel, and when the egg yield from the pen of fowls which had the use of the yard did not indicate that it is necessary for the hens to be out of doors during the winter months.

There was apparently little difference in the amount of feed (concentrates) consumed by each pen, but the results show that the lot which laid the largest number of eggs consumed a little more feed than the other lot. The hens in pen 2 consumed more feed in the first and third periods, and the fowls of both pens ate the most feed at the time when their egg production was the highest. There was no great difference in the physical condition of the fowls of the two lots. In the lot confined, however, the hens seemed to have more completely molted at the end of the first year's work than the lot which had the use of the run.

Ostrich investigations, R. H. WILLIAMS and W. S. CUNNINGHAM (*Arizona Sta. Rpt. 1915, pp. 560–562*).—A distinct difference was noted in the general appearance of eggs laid by hens of different breeds. Observations during the past year indicated no appreciable difference in the number of eggs laid by the South African and Nubian hens, the average number of eggs laid by the South African hens being 20, the Nubian hens 26.5, and the crossbreeds 23.33. More variation was noted between hens of the same breed than the average of different breeds.

It is possible that the South African hens laid smaller eggs than those of the Nubian breeds, but the crossbred hens laid the largest eggs, averaging 1,616.36 gm. The variation, however, between the average weight of eggs laid by the different hens was great. Thus it is noted that the South African hens laid eggs that weighed from 1,279.6 to 5,110.7 gm., and eggs from the four hens of this breed averaged 1,444.03 gm. The crossbred hens laid eggs that averaged 172.6 gm. heavier than the South African and 27.7 gm. heavier than the Nubian hens.

Similar conclusions may be made with regard to the effect of breed upon the width and length of the eggs. The South African hens laid eggs that were rather short in length and round in appearance, while the crossbred and Nubian hens laid eggs that were larger, of about the same diameter, but greater in length. There seems to be a striking correlation throughout between the weight,

length, and width of eggs, and breed characteristics seem to be significant, although not definitely proved.

It has been shown that ostriches are similar to poultry in that hens beginning to lay early in the season are usually the best layers. The four hens that began to lay in January averaged 36 eggs during the season, and produced 72 per cent of the eggs laid during the year, while only 28 per cent came from the other five hens. The average number of eggs laid by hens beginning to lay in February was 21, in March, 11, and in April, 8.

DAIRY FARMING—DAIRYING.

Influence of environment and breeding in increasing dairy production, H. H. Kildee and A. C. McCandlish (*Iowa Sta. Bul. 165* (*1916*), *pp. 383–402, figs. 29*).—In this investigation it was attempted to determine the influence of pure-bred dairy sires in increasing the production from a foundation of scrub cows as well as the effect of improved feeding and management. In order that other influencing factors might be brought to a minimum, scrub cows from an isolated region of Arkansas were selected for the basis of this work in 1907. The work is still in progress and the data presented in this publication are in the form of a preliminary report, taking all records completed up to the end of 1915.

The animals purchased were inferior individuals, being rather small, of very limited abdominal, udder, and vein capacity, and very unprepossessing so far as quality and top lines were concerned. The scrub cows and their calves were given the same care, feed, and shelter as the pure-bred dairy cattle in the herd. This environment has remained fairly constant during the eight years' work. Pure-bred sires of the Guernsey, Holstein, and Jersey breeds were used on these scrub cows and all heifer calves grown under the same conditions as the pure-bred calves on the farm. Heifers by pure-bred sires were bred to other pure-bred sires of the same breed and the heifer calves resulting from this union were also kept for dairy purposes.

The results of the eight years' work as given are summarized as follows: The scrub cows that came to the station when young (four years old) increased in production rapidly and steadily up to the fourth lactation period after reaching the station, when they produced 59 per cent more milk and 54 per cent more fat than during the first period. The scrub cows that came to the station advanced in age did not increase in production after the first year. However, it can not be said that their production was not greater than it had been under their original environment.

The scrub heifers developed at the station averaged 13 per cent more milk and 12 per cent more fat than did the scrub cows that came to the station when four years old or over. The daughters of all except one pure-bred bull have proved to be much better producers, as 2- and 3-year-olds, than their dams as mature cows. The average of all the records made by first generation heifers by a pure-bred Holstein sire show an increase of 2,314.5 lbs., or 71 per cent, in milk and 67.15 lbs., or 42 per cent, in fat, at an average age of three and a half years, over the records of their scrub dams at an average age of six years. The average record of the one first generation Jersey grade that has freshened was 205.6 lbs., or 6 per cent, more milk and 32.9 lbs., or 20 per cent, more fat, at an average age of two and a half years, than the record of her scrub dam at an average age of seven years.

The greatest increase shown by any of the first generation grades was by the second Guernsey bull used. This heifer as a 2-year-old produced 3,451 lbs., or 131 per cent, more milk and 179.22 lbs., or 136 per cent, more fat than the

average record of her scrub dam reared at the station. However, the average records at an average age of three years made by the first generation grades by the first Guernsey sire used were not quite equal to those of their mature dams, and variation in the ability of sires to transmit dairy qualities is deemed a factor to be considered in selecting a pure-bred bull to head a scrub or common herd, as well as for a high grade or pure-bred herd.

In persistency of milk production the grades were intermediate between the scrub and the pure-bred cows in the herd. The first generation grades were much superior to their dams in dairy conformation. Many of the first generation grades showed the characteristic color of their sire's breed; however, in the case of the Holsteins this was not so pronounced until the second generation. There was no appreciable difference between the scrub and grade calves so far as coefficient of digestion is concerned, but the grades had a greater capacity for handling concentrates than had the scrubs.

Silage alone, compared with silage and hay, as roughage for dairy cows, H. P. Davis (*Pennsylvania Sta. Rpt. 1914, pp. 173–182*).—Two lots of five cows each were fed for three periods of four weeks each. Lot 1 received silage alone for roughage during periods 1 and 3 and mixed hay and silage during period 2, and lot 2 received hay and silage during periods 1 and 3 and silage alone during period 2.

The milk yield decreased with both systems of roughage, but the decrease was less with silage and hay. When silage and hay for roughage followed silage alone there was a slight increase in milk yield over the initial production. Except in one instance there was a decrease each period. When the cows received hay they consumed practically the same amount of silage as when no hay was included in the ration. Both lots consumed an excess of protein and net energy above that necessary for maintenence and milk production when based on Eckles' standard. There were no apparent undesirable physical effects from the feeding of silage alone for roughage with the grains used. There was very little difference in the cost of the two rations or in the feed cost of milk and milk fat. No perceptible difference was observed in the health of the two lots.

The effect of open-shed housing as compared with the closed stable for milch cows, H. P. Davis (*Pennsylvania Sta. Rpt. 1914, pp. 183–226, pls. 3*).—Continuing work previously reported (E. S. R., 34, p. 182) the results of three years' studies on the effect of open-shed housing and closed stable are given. Two lots of cows were treated alike in every respect except that of housing, lot 1 being kept outside and lot 2 inside.

From the data presented it appears that cows kept under an open shed have keener appetites and consume somewhat more roughage than those kept in stables. There was sufficient protein consumed, when either Armsby's, Van Norman's, or Eckles' standard was considered, to meet the requirements for milk and to maintain the animals. Figured on Eckles' standard there was a slight excess of energy consumed above maintenance and milk production the first two years, and a small deficiency the last year. When computed on Armsby's and Van Norman's standards there was a deficiency in energy consumed for maintenance and milk production each year, except for lot 1 the second year.

The milk yield of the outside lot for the three years was 35,723.8 lbs. and for the inside lot 35,322.3 lbs. It decreased more rapidly each winter for the outside than for the inside lot. Sudden drops in atmospheric temperature caused decreases in milk yield for both lots, the outside lot having a slightly greater decrease. More bedding was required outside, but less labor was necessary to keep the animals clean. Both lots finished each winter's trial in good health,

with the exception of one cow which reacted to the tuberculin test in April, 1914. She had shown no reaction in two previous tests. The hair of the animals kept outside was longer and coarser the first two winters. The third winter this was noticeable in only one animal.

Studies on the market milk of Iowa, B. W. HAMMER and A. J. HAUSER (*Iowa Sta. Bul. 164 (1916), pp. 311–380*).—In these studies samples of milk, cream, both table and whipping, and buttermilk were examined. The milk and cream samples were scored according to the score cards adopted by the U. S. Department of Agriculture, while the whipping cream was scored according to the cream score card, with the exception that 30 per cent fat was considered perfect and one point was deducted for each half per cent below this. The buttermilk was examined for flavor, fat, and acidity only. The samples were collected in twelve cities of the State of various sizes.

It was found that some of the market milk and cream of Iowa contains excessive numbers of bacteria. In some cities the average bacterial content of the pasteurized product exceeds that of the raw, although most frequently that of the raw is the greater. Some of the milk and cream sold is very poor in flavor, while some is very satisfactory. Only a small percentage of the samples examined were low in the amount of fat or solids-not-fat. Large amounts of sediment are not uncommon, while some samples show only insignificant amounts of sediment. Excessive amounts of acid are sometimes found in both milk and cream. From the results of the investigation it is concluded that the presence of colon bacteria is a rather unsatisfactory basis for judging the sanitary quality of a sample of milk or cream.

A considerable amount of bulk milk is still sold in Iowa. Quart and pint bottles of milk and half-pint bottles of cream commonly showed considerable variations in the amounts of material contained. It is deemed reasonable when buying quarts to expect an amount not over 2 per cent low, when buying pints to expect an amount not over 3 per cent low, and when buying half pints to expect an amount not over 4 per cent low.

A proposed score card for bacteria in pasteurized milk is given.

A study of the manufacture of dairy butter, E. L. ANTHONY (*Pennsylvania Sta. Rpt. 1914, pp. 163–173, pls. 8*).—An experiment was conducted to determine the variations between the different styles of common farm churns as to the percentage of moisture and salt left in the finished butter, as well as the length of time of churning, the percentage of fot left in the buttermilk, and the average rise of temperature of the buttermilk during churning. The types of churn used were a 15-gal. barrel churn, 12-gal. swing churn, and a combined churn and worker. The average moisture content of the butter from the respective churns was 12.39, 13.5, and 13.6 per cent; the average salt content, 4, 3.8, and 2.45 per cent; the time required for churning, 40, 47, and 29 minutes; the rise of the temperature in churning, 6.3, 7, and 5° F.; and the average fat content of the buttermilk, 0.19, 0.229, and 0.18 per cent.

The results of further studies indicate that by properly regulating the churning factors the percentage of moisture can be materially raised without affecting the uniformity. In order to secure a high moisture content it is found better to stop churning while the butter is still in small granules. The studies also showed that with the common hand worker moisture is generally lost as the working progresses, while by working the butter in the combined churn the moisture content increases after a certain amount of working.

Overripened cream did not produce butter of so good quality as cream that was less ripe. In view of those studies it is recommended that cream be ripened to not more than 0.5 per cent acid, and that as low as from 0.3 to 0.4 per cent is advisable under average farm conditions. Three methods (a)

holding cream below 45° until enough had been secured for churning, then raising the temperature to 75° and ripening overnight or till 0.5 per cent of acid had developed, (b) ripening the first gathering at 75° until 0.35 per cent of acid had developed, then cooling to 55°, adding subsequent gatherings, and churning without further ripening, and (c) adding a quart of good buttermilk to the first gathering adding each day's gathering, holding at cellar temperature until enough had been secured for churning, and ripening if necessary by warming to 75° until 0.5 per cent of said acid had developed, were all found to give butter of a quality superior to that secured by the method now commonly used, viz, that of holding cream at cellar temperature without trying to control the bacteria which produce the flavors in cream. With average farm cream handled under proper conditions a uniform butter of good quality and score could be produced. The method of holding cream at 75° until 0.3 per cent acid is developed and then churning it made butter with better keeping qualities. Butter not worked enough was gritty and mottled, but too much working destroyed the grain and resulted in a greasy product.

[Dairy investigations] (*Wisconsin Sta. Bul. 268 (1916), pp. 34–36*).—Tentative results of a study of Wisconsin butter marketing conditions conducted by B. H. Hibbard and A. Hobson in cooperation with the Office of Markets and Rural Organization of the U. S. Department of Agriculture indicate that the quality of butter as it is now handled does not result in a material difference in price. The uniformity in product adherent to the package and the advertising given to the product appear to be factors of no small moment in the determination of price.

In experiments by J. L. Sammis an effort has been made to extend the use of the method of pasteurizing milk for cheese-making purposes by the use of the "holding" instead of the "flash" method of heating. The tentative results secured indicate that a product of good quality can be made, and also point to the possible elimination of the method of acidulating the milk for the restoration of its coagulating power with rennet, as has been found necessary by the use of the "flash" method of heating. The process has proved a success in commercial practice.

Experiments have been made with reference to the application of the method to the manufacture of brick cheese. An improvement in the flavor of the product was secured, the gas-producing bacteria were eliminated, and an increase in yield was obtained.

Making butter and cheese on the farm, C. Larsen and V. R. Jones (*South Dakota Sta. Bul. 164 (1916), pp. 344–374, figs. 18*).—This bulletin gives detailed methods for making butter and cheese on the farm. Among the kinds of cheese discussed are Cheddar, cottage, Neufchâtel, pimento, cream, olive cream, and club cheese.

VETERINARY MEDICINE.

Infection and immunity, C. E. Simon (*Philadelphia: Lea & Febiger, 1915, 3. ed., rev. and enl., pp. X+17–351, pls. 12, figs. 21*).—In this new edition of the work previously noted (E. S. R., 30, p. 878), the recent advances in the study of Abderhalden's protective ferments and the associated technique have received detailed consideration. The section on the Wassermann reaction has been almost entirely rewritten. The manner in which danger from anaphylactic shock during serum treatment may be reduced to a minimum has also received attention. Emphasis has been given to the important observation of Schick and his collaborators that it is possible to recognize those individuals whose blood normally contains a quantity of diphtheria antitoxin sufficient for protective purposes by the aid of an allergic skin reaction.

A bibliography is appended to each chapter and, although not considered complete, represents those papers on which the volume as a whole is based.

International catalogue of scientific literature. R—Bacteriology. QR—Serum physiology (*Internat. Cat. Sci. Lit., 11 (1915), pp. VIII+583+148+27*).—The eleventh annual issue of this catalogue (E. S. R., 32, p. 578), which contains schedules and indexes in four languages and an author and a subject catalogue. The subjects catalogued include general and special bacteriology, parasitic protozoology, and serum physiology.

Histological researches on the behavior of the blood platelets in anaphylaxis, U. PARDI (*Arch. Ital. Biol., 64 (1915), No. 1, pp. 89–96, pls. 2*).—From the studies reported the author concludes that the anaphylactic poison provokes the rapid formation of a thrombus of the platelets in the lungs and liver. There is a close relation between this condition and the morbid phenomena. Such a condition in the pulmonary vessels clearly explains the respiratory symptoms and pulmonary emphysema noted in anaphylactic shock.

The relative value of certain methods for the production of antisheep amboceptor, ROSE SCHWEITZER and V. STEVENS (*Collected Studies Bur. Lab. Dept. Health N. Y. City, 8 (1914–15), pp. 433–435*).—After investigating a number of procedures the following is deemed the most preferable, since it results in the lowest percentage of mortality and in the most potent immune serum: Inoculation of 50 per cent suspension in a series of increasing doses, beginning with 0.25 cc. and increasing 0.25 cc. every third day.

The proteins and antitoxin in the serum of goats immunized against diphtheria, E. J. BANZHAF and L. W. FAMULENER (*Collected Studies Bur. Lab. Dept. Health N. Y. City, 8 (1914–15), pp. 208–212*).—The unit relationship per gram of protein of the pseudoglobulin and euglobulin remained practically the same during the course of immunization.

The diphtheroid bacillus of Preisz-Nocard from equine, bovine, and ovine abscesses.—Ulcerative lymphangitis and caseous lymphadenitis, I. C. HALL and R. V. STONE (*Jour. Infect. Diseases, 18 (1916), No. 2, pp. 195–208*).—The authors report having isolated the Preisz-Nocard bacillus from characteristic abscesses in eleven horses and one calf.

"The etiology of the lesions from which it was obtained is identical with that of caseous lymphadenitis of sheep, and the disease in horses known as ulcerative lymphangitis should be differentiated by laboratory diagnosis from farcy, epizootic lymphangitis, and sporotrichosis, all of which have a mutual resemblance clinically. Bacillus Preisz-Nocard is a diphtheroid bacillus, presenting interesting characteristics as follows: (1) The production of orchitis in guinea pigs, as well as suppurative processes generally throughout the lymphatics; (2) the hemolysis of blood agar plates not containing an excess of fermentable carbohydrate; and (3) the elaboration of a soluble toxin, resembling but not identical with that of diphtheria, yet being neutralized partly by diphtheria antitoxin. This apparent partial neutralization suggests the existence of group reactions among soluble bacterial toxins, analogous to the group reaction of precipitins and agglutinins.

"We again draw attention to the uncertainty of experimental orchitis in guinea pigs as a certain test for glanders, and emphasize the necessity of microscopic and cultural examination of pus from such lesions for diagnostic purposes."

Vaccinoprophylaxis and vaccinotherapeutics of glandular diseases by means of a new antistreptococcus vaccine with sensitized virus, M. CARPANO (*Mod. Zooiatro, Parte Sci., 26 (1915), No. 9, pp. 353–379; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1662, 1663*).—In order to eliminate the susceptibility of treated animals to diseases

due to streptococci during the negative phase after treatment with a "polyvalent antistreptococcus serum" and vaccines now in use, the author has prepared a new polyvalent antistreptococcus vaccine with sensitized virus. The vaccine is obtained from several strains of sensitized streptococci, which are subsequently allowed to sterilize themselves or are killed at low temperatures. The method of preparation is described in detail.

Experimental results submitted show that horses stand small and moderate doses very well which cause no perceptible general reaction when injected subcutaneously. The local reactions are restricted to an edema which afterward hardens and is reabsorbed without forming an abscess. A general effect which may last several days and is undoubtedly due to the absorption and action of the endotoxins produced by the streptococci is manifested after the injection of large doses (50 cc.). For horses of average size the most suitable dose was found to be 25 cc. An active immunity sets in immediately after the injection and is very complete and lasting.

The vaccine also appears to possess undoubted therapeutic properties. This action, though limited, indirectly insures that the vaccine when used for prophylactic purposes will not produce any negative phase. It can therefore be used to advantage in cases of adenitis as well as in suspected infections.

Nitric acid compared with tincture of iodin in the cauterization of wounds infected with rabies virus, D. W. Poor (*Collected Studies Bur. Lab. Dept. Health N. Y. City, 8 (1914–15), pp. 111, 112*).—Results obtained from experiments on three series of eight guinea pigs each show that 75 per cent of the control animals died after an average incubation of $14\frac{5}{6}$ days. Of the animals cauterized with nitric acid only 37.5 per cent died, indicating a saving of 37.5 per cent by means of the acid. Two of the pigs in this group which died of rabies showed an average incubation of 22.5 days, a lapse of time that would permit of a course of Pasteur treatment with a subsequent interval of two weeks for the full development of immunity. Pigs which had their wounds treated with tincture of iodin showed a mortality of 100 per cent. Seven of the animals had an average incubation of $18\frac{5}{7}$ days, and one an incubation period of 29 days.

The practical significance of these results is indicated.

Further studies of biological methods for the diagnosis of tuberculosis, J. Bronfenbrenner, M. H. Kahn, J. Rockman, and M. Kahn (*Arch. Int. Med., 17 (1916), No. 4, pp. 492–508*).—From a further study of the value of biological methods of diagnosis of tuberculosis the authors conclude that "different samples of tuberculin of Besredka, though apparently identical in the mode of their preparation, may differ among themselves in their specific values.

"The most striking variation is in the amount of lipins contained in tuberculin. It is necessary to free each sample of tuberculin of all its lipin fraction before using such tuberculin for the complement deviation test. The lipins may be extracted by fat solvents, but the easiest method was found to be that of separation of the protein fraction by precipitation. Precipitation of the antigenic fraction of tuberculin also offers the possibility of using a standard number of units of antigen and thus eliminating variations due to the quantitative differences in specific properties of different samples of tuberculin, without increasing the chance of obtaining lipotropic reactions.

"It seems, however, that different samples of tuberculin may vary also qualitatively. The variation rests apparently on the fact of the existence of strain specificity in the antibody. The existence of strain specificity in tuberculosis may explain why the results obtained by different investigators in the complement-deviation test for diagnosis of tuberculosis vary so much.

"The tuberculin of Besredka seems to give the best results in diagnosis by the complement-deviation test. Even though the test is positive in a certain number of clinically nontuberculous cases, the reaction seems to be specific. In at least 87 per cent of such cases the fixation was obtained also with one or more preparations of tuberculins other than that of Besredka."

A bibliography of 47 references to the literature cited is included. See also a previous note by Craig (E. S. R., 35, p. 180).

Report on tuberculin tests, L. Cobbett and A. S. Griffith (*Roy. Com. Tuberculosis, Final Rpt., II, App., Sup. Vol., 1913, pp. 148, figs. 101*).—This supplemental volume reports the results of tuberculin tests on the ox, pig, goat, horse, rhesus monkey, chimpanzee, baboon, mangabey monkey, lemur, dog, cat, rabbit, and fowl. The effect of the successive injections of tuberculin into tuberculous animals, the action of homologous and heterologous tuberculin, the effects of tuberculin when given by channels other than that usually employed, the more immediate effects of injecting living tubercle bacilli into tuberculous animals when compared with those produced by tuberculin, and the ophthalmic tuberculin test were also studied and the results reported.

The experimental results are reported in tabular form, and the febrile conditions of the animals after inoculation are presented graphically. See also a previous note (E. S. R., 35, p. 75).

The characteristics of tubercle bacilli in human bone and joint tuberculosis, A. Eastwood and F. Griffith (*Jour. Hyg. [Cambridge], 15 (1916), No. 2, pp. 257–309*).—The results of an investigation of 261 cases are summarized in the following table:

Types of tubercle bacilli at different age periods.

Age period.	Number of cases.	Human.	Bovine.	Atypical.
Years.				
0–5	47	31	14	2
5–10	108	75	31	2
10–16	62	52	7	3
16–25	15	12	3	....
Over 25	29	26	....	3

The percentage of bovine cases for all ages from this series is thus 21.1; for cases under ten years, 29; and for cases over ten years, 9.4.

Clinical data and bacteriological results of the cases are reported in detailed tabular form, together with the results and post-mortem findings of inoculation experiments on rabbits with viruses of "human" and "bovine" types of bacilli obtained from the organisms isolated from some of the cases.

The types of tubercle bacilli occurring in tuberculosis of the human genito-urinary tract, A. Eastwood and F. Griffith (*Jour. Hyg. [Cambridge], 15 (1916), No. 2, pp. 310–314*).—In an examination of 17 cases the "human" type of bacillus was obtained in 14 instances and the "bovine" in 3. The 3 "bovine" cases were affections of the kidney in persons aged, respectively, 25, 19, and 20 years.

The clinical data and bacteriological results of the cases examined are reported in detailed tabular form.

Avian tuberculosis, C. H. Higgins and A. B. Wickware (*Canada Dept. Agr., Health Anim. Branch Bul. 18 (1915), pp. 10, pl. 1, figs. 3*).—This bulletin briefly discusses the prevalence, symptoms, and course of the disease; post-mortem findings; transmission of tuberculosis from birds to man; and prevention and treatment.

The authors have observed and demonstrated the presence of the disease in two canaries. Gross lesions were present in nearly every organ and microscopic examination showed great numbers of acid-fast bacilli of the avian type. The disease has also been observed in turkeys in a number of instances.

Investigations to determine the possibility of congenital tuberculosis being present in chicks have been carried on by the authors, but the experiments in this connection have thus far yielded only negative results. The results however, are not considered conclusive.

In an examination of eggs bacilli microscopically indistinguishable from those of tuberculosis were found in about 20 per cent of the eggs examined. Subsequent inoculation of guinea pigs with material from these eggs produced a generalized tuberculous infection from which typical avian cultures were procured.

In experiments with tuberculin as a practical method of diagnosis no marked variation in temperature was observed in four fowls which received 2 cc. of avian tuberculin subcutaneously. In four fowls which were given 1 cc. of concentrated tuberculin intradermally (the thickened skin of the breast) no evidence of any local or thermal reaction was observed. Fowls which received one drop of tuberculin in the eye manifested no evidence of an ophthalmic or a thermal reaction.

Further studies on the nutritive deficiencies of wheat and grain mixtures and the pathological conditions produced in swine by their use, E. B. HART, W. S. MILLER, and E. V. McCOLLUM (*Jour. Biol. Chem.*, *25* (*1916*), *No. 2, pp. 239–259, pls. 5, figs. 9*).—The animal (swine) feeding experiments herein reported supply information regarding the rôle played in both animal and human nutrition by toxic materials in apparently normal food products, the results reported being supplementary to those obtained by the authors in earlier work (E. S. R., 35, p. 472). Their conclusions are in part as follows:

"Malnutrition, histologically characterized by nerve degeneration, may result from the absence of certain factors in the diet, as in the case of beriberi. A similar condition may likewise arise from the presence of toxic materials in apparently normal food products and in the presence of all known factors essential for continued growth and well-being.

"With a large mass of wheat in the ration of swine toxicity will follow, even in the presence of all the recognized factors for growth. Only in the presence of very liberal quantities of all these factors can the effect of the toxicity be overcome. This toxicity manifests its action by producing important histological changes in the nervous system of the animal, not unlike those recorded for beri-beri. No one important factor for growth, such as better proteins, salts, or fat-soluble A, appears able to act as a complete corrective for this toxicity.

"It also appears possible to produce similar pathological conditions in swine in the absence of all known toxic material and in the presence of a fair quality of protein, a plentiful supply of fat-soluble A and water-soluble B, but a poor salt mixture, namely, that natural to the grains used."

Studies on the transmission and prevention of cestode infection in chickens, J. E. GUTBERLET (*Jour. Amer. Vet. Med. Assoc.*, *49* (*1916*), *No. 2, pp. 218–237*).—"The results of these experiments show that the intermediate (cysticercoid) stage of *Choanotænia infundibuliformis* occurs in the common house fly (*Musca domestica*). The results were obtained by feeding flies on eggs of the tapeworm and raising cysticercoids in a fly; also by feeding chicks on flies and raising the worms in the birds. By morphological comparison of the cysticercoid and an adult they are shown to be identical. Results from experi-

ments by feeding flies on eggs from *Davainea cesticillus* and *D. tetragona* were negative.

"The habits of the birds are important factors to be considered in experimental work for life-history studies. Certain insects are found in great numbers around chicken houses and yards and are readily eaten by the birds. Flies are known to contain the larval stage of one species of cestode, and some other species of insects are to be considered as probable intermediate hosts for other species of cestodes.

"The symptoms and effects of the infection from tapeworms vary with individual birds, age of birds, and the degree of infection. Birds infested with worms display an emaciated, unthrifty condition, an unnatural desire for food and water, and a marked diarrhea, with droppings of a characteristic yellowish-brown color.

"The control of tapeworm disease in chickens is in an unsettled condition. Little can be done until more is known concerning life histories of worms. Preventive measures are urged rather than curative measures. Droppings should be cared for and treated with appropriate substances in order to prevent insects from feeding on them or developing in them. Experiments by giving lye with food to infested chickens showed satisfactory results in removing tapeworms.

"The flocks of chickens that were studied showed at times a very heavy infection, and nearly every bird examined harbored one or more species of worms. Five species were found in the chickens at Hardy, Nebr., and three in the birds at the poultry farm at the University of Illinois. The species found in Nebraska are *D. cesticillus*, *D. tetragona*, *D. echinobothrida*, *Hymenolepis carioca*, and *C. infundibuliformis*. At the poultry farm of the university the species *D. cesticillus*, *D. echinobothrida*, and *H. carioca* were found."

RURAL ENGINEERING.

Annual report of the agricultural engineer during 1914–15, W. M. Schutte (*Ann. Rpt. Dept. Agr. Bombay, 1914–15, pp. 72–87*).—This is a report of the activities of the agricultural engineer's office, which included experiments on implements and machinery, power, irrigation, water supply, and mechanical cultivation.

Methods of stream gaging, W. S. Pardoe (*Engin. News, 75 (1916), No. 19, p. 889*).—This is a mathematical analysis of computation methods generally used.

Surface water supply of the Great Basin, 1913 (*U. S. Geol. Survey, Water-Supply Paper 360 (1916), pp. 293, pls. 2, fig. 1*).—This report, prepared in cooperation with the States of Utah, Nevada, California, Oregon, and Idaho, presents the results of measurements of flow made during 1913 on streams in the Great Salt Lake and Sevier Lake basins, minor basins in Nevada, Humboldt-Carson sink basin, Pyramid and Winnemucca lakes basins, Surprise Valley, and Honey, Warner, Abert, Silver, Malheur, and Harney lakes basins.

Surface water supply of St. Lawrence River basin, 1914, W. G. Hoyt, A. H. Horton, C. C. Covert, and C. H. Pierce (*U. S. Geol. Survey, Water-Supply Paper 384 (1916), pp. 128+XXIX, pls. 2*).—This report, prepared under the direction of N. C. Grover and in cooperation with the States of Minnesota, Wisconsin, New York, and Vermont, contains the results of measurements of flow made in 1914 on streams tributary to Lakes Superior, Michigan, Huron, Erie, and Ontario and to the St. Lawrence River.

Surface water supply of the Lower Mississippi River basin, 1914, N. C. Grover, R. Follansbee, and G. A. Gray (*U. S. Geol. Survey, Water-Supply

Paper, 387 (1916), pp. 60+XXXIV, pls. 2).—This report, prepared in cooperation with the States of Colorado and New Mexico, presents the results of measurements of flow made on streams in the Arkansas and Red River basins during 1914.

Surface water supply of New Mexico, 1914, J. A. French (*Santa Fe, N. Mex.: State Engin. Dept., 1914, pp. 151, pls. 4*).—This report, prepared in cooperation with the U. S. Geological Survey, presents the results of measurements of flow made on streams in the principal river basins of New Mexico in 1914.

Geology and underground water of Luna County, New Mexico, N. H. Darton (*U. S. Geol. Survey Bul. 618 (1916), pp. 188, pls. 13, figs. 15*).—This is a more complete and detailed report of work previously noted (E. S. R., 32, p. 384).

Geology and ground waters of northeastern Arkansas, L. W. Stephenson and A. F. Crider (*U. S. Geol Survey, Water-Supply Paper 399 (1916), pp. 315, pls. 11, figs. 4*).—This report describes the physiography and geology of northeastern Arkansas and discusses the occurrence and distribution of surface and ground water by counties. A section, by R. B. Dole, on the chemical character of the surface and ground waters of the region is also included.

Colorado River and its utilization, E. C. La Rue (*U. S. Geol. Survey, Water-Supply Paper 395 (1916), pls. 25, figs. 5*).—This paper gives the results of measurements of flow made on the Colorado River and its tributaries and deals with the utilization of the water for irrigation and power development purposes.

Physical properties of some toxic solutions, G. B. Rigg, H. L. Trumbull, and Mattie Lincoln (*Bot. Gaz., 61 (1916), No. 5, pp. 408–416*).—Experiments on the osmotic pressure and surface tension of (1) water obtained from sphagnum bogs of the Puget Sound region and Alaska, and (2) solutions obtained by allowing rhizomes of *Nymphæa polysepala* to decay in water are reported.

It was found that " the osmotic pressure of bog water in the samples tested was higher during the rainy season than at the close of the dry season. The osmotic pressure of the waters tested from lakes and springs was lower during the rainy season than at the close of the dry season. There is no indication that either high osmotic pressure or low surface tension is an important factor in the toxicity of bog water or of very dilute solutions resulting from the decay of Nymphæa rhizomes."

Tests of a new process of sewage purification with grease recovery and apparent profit, R. S. Weston (*Amer. Jour. Pub. Health, 6 (1916), No. 4, pp. 334–343, fig. 1; abs. in Engin. News, 75 (1916), No. 19, p. 913*).—Experiments with Boston sewage conducted by E. S. Dorr and by the Massachusetts Institute of Technology are reported and compared. The process involves the addition of either sulphuric or sulphurous acid to the sewage to precipitate the bulk of the solids in the form of a sludge which can be dried and degreased, the purpose being to produce a greaseless fertilizer and to save the grease.

From the experiments by Dorr it was concluded that each 1,000,000 gal. of sewage would yield 1,361 lbs. of fertilizer base, " which was estimated according to agricultural standards to be worth $13.59 a ton.

The Massachusetts Institute of Technology experiments verified the results with reference to the amount of sludge obtained from Boston sewage. The results obtained were taken to indicate " that the sludge from the Miles process, although less in bulk than that from the activated sludge process, has a value of more than $24 per million gallons of sewage."

Irrigation investigations, G. E. P. Smith and A. L. Enger (*Arizona Sta. Rpt. 1915, pp. 570–577, figs. 2*).—The work in irrigation investigations at the station for the year is reviewed. Data on the economics of pump irrigation indicate that "in general, the most advisable practice consists in wells of 600 to 2,000 gal. capacity, pumps of the sizes from 4 to 8 in., 4-cycle oil engines of from 12 to 60 horsepower, and enough farmers cooperating—two,three, or four—to utilize fully the plant 140 hours each week through the good growing months from April to August."

Tests of a 15-in., 5-stage, 110-ft. pump with the bottom of the bowls 28.5 ft. below normal water level are also reported. "The tests show that a very high efficiency can be obtained with this type of pump if the pump is working under its best conditions of head and discharge, but that at other heads or other discharges the efficiency may be low. This emphasizes the importance of knowing the operating conditions in advance and of buying a pump especially designed for those conditions."

The irrigation of sugar cane in Mauritius, F. A. Stockdale (*Dept. Agr. Mauritius, Gen. Ser., Bul. 6 (1916), [English Ed.], pp. 12, pl. 1, fig. 1*).—This pamphlet deals with the scientific principles and the essentials of practice of irrigation with special reference to the irrigation of sugar cane on the island.

The operations of the Royal Commission of Irrigation in the first triennium, O. Bordiga (*Atti R. Ist. Incoragg. Napoli, 6. ser., 66 (1915), pp. 1–16*).—The first three years' activities of the commission are reported, which deal briefly with defects in the irrigation laws of Italy; irrigability of lands; irrigation economics; and irrigation water, its quality and action on crops and soil.

Annual irrigation revenue report of the Government of Bengal for the year 1914–15 (*Ann. Irrig. Rev. Rpt. Bengal, 1914–15, pp. II+71, pl. 1*).—This report covers the year 1914–15.

Report of the state drainage commission of Minnesota (*Rpt. State Drain. Com. Minn., 1915, pp. 68, pls. 11*).—This reports the activities of the state drainage commission of Minnesota and the work and expenditures of the state drainage engineer's office. The text of the laws prescribing the duties and defining the powers of the state drainage commission is also given, together with engineering information regarding drainage areas in Minnesota, evaporation, precipitation, run-off waters and formulas, state ditches, and maximum, minimum, and average discharge of various streams of the State.

Tests show strength of corrugated culvert pipe, G. L. Fowler (*Engin. Rec., 73 (1916), No. 21, pp. 668, 669, figs. 4; abs. in Engin. News, 75 (1916), No. 20, p. 958*).—Tests under hydrostatic pressure of 12-, 24-, and 48-in. corrugated iron pipes with corrugation depths of $\frac{1}{2}$ and $\frac{3}{4}$ in. and uniform pitch of corrugations of $2\frac{2}{3}$ in., and sand bed tests of the same, are reported. Considering the three variables, diameter of pipe, thickness of metal, and depth of corrugation, the following formula was developed:

$$P=\frac{5{,}960CT}{2\left(\frac{D-12}{12}\right)}\left(1-0.4\log\frac{D}{12}\right)$$

where P=collapsing pressure in pounds per square inch, C=corrugation depth in inches, T=thickness of metal in inches, and D=inside diameter in inches.

For sizes from 10 to 24 in., metal thicknesses of from 0.0625 to 0.141 in., and working pressure of half the collapsing strength, the formula was simplified to $\textit{working pressure}=\frac{34{,}000CT}{D}$ on the assumption that for this range of sizes the collapsing pressure varies inversely as the diameter.

In the sand bed tests it was found that there was arching of the sand under pressure. "It was found that the lateral thrust rose to a maximum under a shallow depth and remained practically constant. With a slightly yielding bottom the sand arched to relieve the bottom of load which was carried by frictional resistance of sand against the box sides. In the main tests, it was found that when the platen was wider than the pipe the pressure was largely supported by the column of sand over the pipe and less by the more yielding sand beyond the pipe walls. Then the load imposed on the pipe was greater than as if considered uniformly distributed by the platen. The results exhibited the conveyance and distribution of sand pressures, but were not considered sufficient to warrant developing a formula for calculating culvert pressures. For instance, it was seen that the top pressure on pipe decreases with a given load placed on increasing depths of sand, but the proportional relations were not disclosed. The lateral pressures were low and no definite ratio was established. The lateral pressure increased rapidly from the top down to a point determined by the angle of repose of the sand and then decreased. . . .

"It is concluded that under the heaviest load that can now be applied to railway ties by any existing locomotive or car, a 24-in. 14-gage pipe with ½-in. depth of corrugation, and under 24-in. cover of dry sand, can not be deflected beyond its elastic properties of complete shape recovery. The 36- and 48-in. culverts are held to be uncrushable under a cover equal to their own diameter. The weight of cover in a wide loose fill or bank is not so well supported as in a ditch, and it was concluded that conditions of unusual severity might be induced which should be provided for by heavier metal."

Experiments on the distribution of vertical pressure in earth, R. B. FEHR (*Ann. Rpt. Penn. State Col. 1914, pp. 117–123, pls. 13*).—The results of tests with dry sand, silty yellow clay, gravelly silt loam, and brown dry river sand, and on a mixture of these, to determine the distribution of pressure due to a concentrated load through various depths of the soils are graphically reported, together with a description of methods and apparatus used.

"The following depths of sand were tested: 3, 6, 12, 18, 24, 36, 48, and 59 in. For each depth the eccentricity of the load was varied from 0 to 42 in. both right and left. The loads were applied in increments of 1,000 lbs. as indicated by the gage up to the point where the loading strip sank into the sand as fast as the load was applied. As determined from the calibration curve these loads varied from about 600 lbs. to between 2,200 and 6,000 lbs., according to the depth of the sand."

It was found that "there was a very marked change in the percentage of transmission when the eccentricity of the load was equal to the width of the weighing strip and at this point the maximum value was 13 per cent. For greater eccentricities this value was never exceeded. . . . The size of the restricting box does not make any appreciable difference in the results. The maximum bearing power of the sand decreased with the depth of sand. . . . There was a distinct tendency for the percentage of transmission to increase as greater loads were applied."

With the clay loam sand mixture "the method of procedure was exactly the same as in the sand tests except that the eccentricity of the load was varied from 24 in. right to 24 in. left, and back across the soil to the starting point. . . . The depths tested were as follows: 6, 9, 12, 18, 24, and 36 in. . . .

"In practically all cases there was quite a regular increase in the percentages of transmission as the load varied from 600 to 10,000 lbs. per square foot, the maximum loads causing an average increase of 36 per cent in the transmission as produced by the minimum loads. . . . The tests in loam were run in exactly

the same way as those on the clay mixture, but only on 6, 12, 24, and 36-in. depths. . . . As in the case of clay there was quite a regular increase in the percentage of transmission as the loads varied from 500 to 10,000 lbs. per square foot, the average increase from minimum to maximum being 47 per cent."

It is generally concluded that "the percentage of transmission increases with increase of load. For depths of earth greater than 2 ft. the percentage of transmission is always less than 20. For eccentric loads the percentage of transmission is always less than 20 when the loading strip is not over any part of the weighing strip."

Pressure of wet concrete on the sides of column forms, A. B. McDaniel and N. B. Garver (*Engin. News, 75 (1916), No. 20, pp. 933–936, figs. 5*).—Field and laboratory tests made at the University of Illinois are reported.

The laboratory tests were made on 12- and 20-in. square column forms 12 ft. high made of planks, with ship lap joints. The concrete was a 1:2:4 mixture of standard cement, glacial sand, and crushed limestone. The following conclusions were drawn: "The lateral pressure increases with the head up to a certain point, after which the pressure remains nearly constant until the pouring ceases. It is probable that, during the early part of the pouring, the concrete is supported by pressure upon the base of the form, and later a considerable part of the concrete is supported by arch-like action on the sides of the form. In this respect the action of green concrete seems to be similar to that of grain, seeds, clean dry sand, etc., in a bin. The lateral pressure in general corresponds to hydrostatic pressure for wet concrete. The lateral pressure increases with the rate of pouring and the degree of wetness and of the consistency. The lateral pressure is about the same for column forms up to 20 in. square."

The field tests were conducted on a reinforced concrete arch highway bridge. "The tests were made on the spandrel posts of the longer spans. These posts have a cross section of 23 by 30 in. and a maximum height of about 15 ft. They have both vertical and horizontal reinforcing bars." The concrete was a 1:2:4 mixture of cement, sand, and gravel. It was found "that the pressure gradually increases with the head until a maximum is reached, after which the pressure falls off. The height at which this maximum pressure occurs depends upon the consistency of the concrete and upon the rate of pouring. The actual pressures recorded approximate very closely that of a liquid having the same weight as the concrete, or about 145 lbs. per square foot per foot of head.

"The results obtained from the field tests agree closely with those secured from the laboratory tests. Concrete falling against the forms may result in high lateral pressures due to impact. A value of 145 lbs. per square foot [per foot] of height would be a rational value for lateral pressure to use in the design of forms. The results of these tests are not conclusive, but it is believed that they are sufficiently consistent and accurate to furnish lateral-pressure values which may be used as a basis for the design of forms under average working conditions."

Dynamite experiments, B. Bunting (*Agr. Bul. Fed. Malay States, 3 (1915), No. 9, pp. 337–341; abs. in U. S. Dept. Com., Com. Rpts., No. 102 (1916), p. 416*).—Experiments to test the effect of explosives on the growth of rubber in loam soil overlying a heavy clay are reported.

"Taking the experiments over a period of one year it [was] observed that whereas the control gave an increase of 21.93 in., the dynamite plat gave an increase of 32.14 in. for every 100 in. of the original girth, or an increase over the control of 10.2 per cent. . . .

"Dynamite is unequaled for breaking up hardpan or layers of impervious subsoil, which not only prevent the roots from going down to the subsoil but interfere with the drainage. It is most effective on heavy clay and hard laterite soils and least effective on light or loose soils which offer no resistance to the explosion. It might be profitably employed in holing previous to planting, especially in heavy soils, half a charge of dynamite being sufficient for this purpose. It may be successfully used in breaking up logs and tree stumps infected with termites in rubber clearings. The value of dynamite for cultivation is not doubted, but the high cost of the explosive prevents its more general use."

Stump removal, G. Lundberg (*Skogsvårdsför. Tidskr., No. 5 (1915), Sup. 1, pp. 40, figs. 25*).—This report deals with stump breaking and removal and describes and illustrates methods and machinery used in this work in Sweden.

The American road, I, II, J. I. Tucker (*Norman, Okla.: Author, pts. 1, 1915, pp. 34+[5]; 2, 1916, pp. 35–82+[4], figs. 5*).—Questions and texts prepared for the extension division of the University of Oklahoma are given.

Road laws of Ohio (*Columbus, Ohio: Bd. Library Comrs. Ohio, 1915, pp. XXXIX+335*).—The text of the laws is given in three parts.

Part 1 includes the Cass highway act, which is a codification and revision of the more important road laws that were in force previous to its enactment. Part 2 contains sections of the general code relating to the duties of various county and township officials in connection with roads and the provisions relative to tax levies and the limitation of the tax rate. In many instances citations are given to court decisions. Part 3 presents the law relating to motor vehicles.

Good roads year book, 1915 ([*Off.*] *Good Roads Year Book U. S., 1916, 5. ed., pp. VIII+440*).—This is the fifth number of this book (E. S. R., 29, p. 388), containing information regarding road improvements under federal, state, territorial, and local control; historical notes and technical details of road construction and maintenance; and European road systems. Miscellaneous information regarding highway bonds, state geologists, and manufacturers of road machinery and equipment, engineering equipment, and road-building materials is included, together with a bibliography of 249 treatises on road, bridge, and culvert construction and allied subjects.

Proceedings of the Pan-American Road Congress, held at Oakland, California, September, 1915 (*Proc. Pan-Amer. Road Cong., 1915, pp. XV+416, pl. 1*).—These proceedings contain the following special papers:

The History and Future of Highway Development, by L. W. Page; The Relation of the Road to Rail and Water Transportation, by C. J. Tilden; The Benefits and Burdens of Better Roads, by S. E. Bradt; Road Building in the National Forests, by H. S. Graves; The Essentials of Proper Laws for Highway Work, by E. A. Stevens; Federal Aid to Rural Districts, by C. L. MacKenzie; Proper Road Location, Its Importance and Effects, by W. R. Roy; Road Drainage and Foundations, by G. W. Cooley; Highway Bridges and Structures, by W. S. Gearhart; Highway Indebtedness, Its Limitation and Regulation, by N. P. Lewis; Organization and System in Highway Work, by A. B. Fletcher; The Educational Field for State Highway Departments, by L. S. Smith; Roadway Surfacings, by F. F. Rogers; Resurfacing of Old Roads, by W. D. Uhler; Street Pavements, by C. Hill; System in Highway Accounting, by S. D. Gilbert; Uniformity for Highway Statistics and Data, by H. E. Reed; Engineering Supervision for Highway Work, by P. Hubbard; The Determination of the Justifiable Outlay for Specific Cases of Highway Improvement, by C. Richardson; How to Take the Roads Out of Politics, by R. H. Dana; Con-

vict Labor for Highway Work, by G. P. Coleman; Motor Traffic, Its Development, Trend, and Effects, by A. W. Gould; Equipment for Highway Work, by A. H. Blanchard; Comparisons of Traffic and Their Economic Value, by L. White; Maintenance—Materials and Methods, by A. W. Dean; and Dust Suppression and Street Cleaning, by W. H. Connell.

Grading aggregates for Illinois concrete roads, A. H. Hunter (*Concrete [Detroit, Mich.], 8 (1916), No. 5, p. 209*).—A table giving the present requirements as to gradation of aggregates for concrete road work in Illinois is given, together with a table of unit costs of several concrete roads built by day labor under the supervision of the Illinois Highway Commission.

Test of Douglas fir bridge stringers, H. B. MacFarland (*Bul. Amer. Ry. Engin. Assoc., 17 (1916), No. 184, pt. 2, pp. 281–467, figs. 153; abs. in Engin. and Contract., 45 (1916), No. 19, pp. 427–430, fig. 1; Engin. Rec., 73 (1916), No. 15, p. 479*).—Tests of 61 representative Douglas fir stringers in which the stringers were subjected to a process of creosoting involving boiling under vacuum are described. Nine of the specimens were put to special tests after treatment, while 52 stringers were cut in two and comparative tests made of the untreated and treated halves.

"A comparison of the results of the transverse tests, applying loads at the third points, of 7 by 16 in. by 14 ft. span treated and untreated stringers shows that of the 52 representative untreated specimens 16 failed by shear, 29 by tension, 3 by tension and shear, 2 by crushing and tension, 1 by crushing and shear, and 1 by crushing, while the following numbers of treated stringers failed from the causes noted: Thirty-two shear, 14 tension, 4 tension and shear, and 2 crushing and shear. . . . The average elastic limit of the untreated pieces was 4,269 lbs. per square inch as compared to 3,481 lbs. per square inch for the treated stringers. The average modulus of rupture was 5,691 lbs. per square inch for the untreated and 4,680 lbs. per square inch for the treated stringers. The average longitudinal shear for the untreated pieces was 411 lbs. per square inch, which was 78 lbs. per square inch greater than that for the treated specimen.

"Specimens for the compression tests, applying the load parallel to the grain, were 5 by 5 by 12 in. in size. It was found that the maximum load for the untreated pieces was 4,114 lbs. per square inch and 3,869 lbs. per square inch for the treated blocks. Applying the load perpendicular to the grain of 6 by 6 by 30 in. blocks showed that the treated specimens had an average elastic limit of 322 lbs. per square inch, which was 116 lbs. per square inch less than the average for those that were not treated. The average area penetrated by creosote as determined by this test was 20.41 per cent."

The following conclusions were drawn: "Moisture may be successfully removed by boiling under vacuum. Moisture determinations show that, on an average, 35 per cent of the total moisture was removed by the process. The removal of moisture by boiling under vacuum, preliminary to creosoting, decreases the physical strength of the material. The weight of creosote per unit of volume for treated material is dependent on the structure of the specimen. Spring wood offers greater resistance to treatment than summer wood. Special tests of treated stringers indicate that the decrease in physical strength due to treatment is not confined to the area penetrated by creosote. The entire structure is affected. The compressive strength parallel to the grain was decreased 6 per cent. The compressive strength perpendicular to the grain was decreased 26 per cent. Although the average strength of the treated material is appreciably decreased, its stiffness, as measured by the modulus of elasticity, is not affected. In general, the average strength of

Douglas fir bridge stringers, subjected to the boiling-under-vacuum process of creosoting, was five-sixths of its original strength."

Automobile registrations, licenses, and revenues in the United States, 1915 (*U. S. Dept. Agr., Office Sec., Circ. 59* (*1916*), *pp. 15, fig. 1*).—This bulletin contains tabulated data on the following: Motor-vehicle registrations, licenses, and revenues, 1915; motor-car registrations and gross motor-vehicle revenues, 1913–1915; motor-vehicle registration and license fees in force January 1, 1916; and administrative provisions in force January 1, 1916, affecting motor-vehicle registrations, licenses, and revenues.

"During 1915 the total gross revenues derived from the registration of motor vehicles and the licensing of operators, chauffeurs, dealers, etc., amounted to $18,245,713. . . . Of the total revenue collected during 1915 practically 90 per cent was applicable to road work, and of this slightly over 70 per cent was placed more or less directly under the control and supervision of the state highway departments. . . .

"The number of motor vehicles registered under the general designation of automobiles, motor trucks, and commercial vehicles in continental United States during 1915 amounted to a total of 2,445,664. The total road mileage of the United States outside of incorporated towns and cities is approximately 2,375,000 miles. There is, therefore, an average of slightly more than one motor car for each mile of rural public road in the United States."

Prevention of pounding in kerosene engines, J. A. Moyer and J. P. Calderwood (*Ann. Rpt. Penn. State Col., 1914, pp. 109–117, pls. 10*).—Experiments with a 4-cycle hit-and-miss governed oil engine with a cylinder bore of 6.75 in., a 10-in. stroke, and a clearance of 22.9 per cent to determine the cause of pounding and methods for its prevention are reported. The carburetor was an experimental spraying type.

It was found that pounding was increased by increasing the temperature of the gas, increasing the temperature of the jacket water, and increasing the spark advance. Pounding was decreased by increasing the fuel rate and increasing the water injection. "In attempting to draw conclusions from these results it is practically impossible to state whether this pounding was produced by cracking of the heavier hydrocarbons or by high flame propagation, but from a practical point of view the conditions affecting either of these causes are identical, and inasmuch as we can prevent or govern this pounding by the use of water and rich fuel mixtures, meaning a relatively large amount of kerosene used compared with the air, it seems that differentiation as to ultimate cause is not necessary. . . . In using gasoline under conditions of fuel mixture and water temperature similar to those imposed upon kerosene in these tests the pounding and the indicator cards are identical with those of kerosene. These tests show also very clearly that the temperature of the fuel mixture at the firing period is the condition that governs the quality of the pounding."

Directory and specifications of leading makes of trailers (*Farm Machinery, No. 1284* (*1916*), *pp. 18, 19*).—This list contains the names and specifications of 75 types of trailers of 30 different makes.

Official tests of mechanical cultivation, Ringelmann (*Jour. Agr. Prat., n. ser., 29* (*1916*), *No. 4, pp. 74, 75*).—The more important results of tests of several outfits are summarized in the following table.

Results of mechanical plowing tests.

Type of outfit.	Depth of plowing.	Width of plowing.	Average speed per hour.	Area plowed per hour.	Fuel consumption.	
					Per hour.	Per hectare.
	Centimeters.	*Meters.*	*Meters.*	*Square meters.*	*Kilograms.*	*Kilograms.*
Motor cultivator	3.5	1.00	4,572	3,165	3.55	11.2
Motor plow	14.4	.56	4,032	1,346	5.98	44.4
Tractor	15.0		2,952	1,306	5.42	41.5
Do	16.0	.96	2,880	2,043	7.73	37.8
Do	24.0	.59	2,916	1,214	5.83	48.0
Do	15.8	.57	2,952	1,054	10.42	98.8
Do	18.1	.59	4,860	1,540	8.70	56.5
Do	13.2	1.50	1,728	1,830	4.43	24.2
Do	12.3	.99	3,132	2,116	8.12	38.4
Do	16.1	.99	3,024	2,052	9.40	45.8
Do	18.0	1.25	2,700	2,280	10.01	43.9
Do	14.2	1.19	2,880	2,134	6.89	32.3
Do	15.4	1.17	2,844	2,110	6.74	31.9
Do	16.5	1.20	3,060	2,371	7.04	29.7

Power required for grinding Pennsylvania and Argentine cereals in flour mills, D. W. DEDRICK (*Ann. Rpt. Penn. State Col. 1914, pp. 123–133, pls. 10*).—Tests to determine the relative amount of power required for grinding winter and spring wheat, the effect on power requirements for the mill occasioned by the conditioning of wheat by the application of moisture to the wheat hull, and the power required for grinding corn and other grains are reported.

It was found "that the winter wheat, conditions being equal, takes considerably less power than spring wheat, and again tempered or conditioned wheat less power than dry. Also that the mills with longer or more roll surface take less power than with shorter or less roll surface, as a comparison of the four tests on spring wheat shows that the five-break, ten-reduction mill takes the least and the three-break, five-reduction mill, the most power. The dry wheat takes more power than the conditioned wheat to which had been added 3 per cent of water and lying six hours to mellow. . . .

"It was found that when the brushes or scrapers were adjusted, as is usual against the rolls to scrape off material adhering to them in crushing, the rolls took on an average 27 per cent more power than when running with the scraper off. However, in grinding with full load this relation would be changed to about 8 per cent of the power to the rolls. . . .

"It required a little over 38 per cent more power to grind the same quantity of Argentine corn in the same time to the same degree of fineness than for the Dent variety. The second grinding took on an average 68 per cent more power than the first grinding. Power for grinding ordinary white corn is practically the same as that for Yellow Dent. . . .

"The graphic chart shows that there were differences in cleaning wheat, also that the corn took less power for cleaning than wheat. . . . The winter wheat took 50 per cent of the power to the scourer, the spring wheat dampened 47.73 per cent, and the spring wheat dry 45.24 per cent, while the corn took 40.3 per cent. . . .

"In the large class of mills the proportion of roll surface and other machinery per barrel is generally considerably less than that for a small mill, and is owing to a more minute division of and consequently a more equitable distribution of stock throughout the mill. A 25, 50, or 75 barrel mill will use 1.8 to 2 in. per barrel or even more, whereas a 500 or 1,000 barrel mill will use 1.7 to 1.6 in. or even less per barrel and consequently somewhat less

power per barrel. The following formula may be used for determining capacity and power:

$$C=\frac{d\ n\ S\ l}{f\ b};\ h=\frac{l}{c}\text{ and }T=C\ p\text{ where}$$

C=capacity in barrels; d=diameter of roll, inches; n=3.1416; S=speed of fast roll, revolutions per minute; l=total length of roll surface, inches; f=constant used=109; b=barrel=196 lbs.; h=inches roll per barrel; p=horsepower per barrel, as 0.4 for plain, 0.35 for collar, and 0.26 for ball bearing; T=total horsepower for mill."

Composition of galvanized-wire fencing materials, E. S. ERB and W. FREAR (*Pennsylvania Sta. Rpt. 1914, pp. 377–390, pls. 3*).—This article reports studies of the composition of more or less well-known wire fencing materials and of newly purchased portions of the principal commercial brands on sale in Pennsylvania, together with a description of methods of analysis.

Farm buildings, how to build them, W. E. FRUDDEN (*Charles City, Iowa: Author, 1916, pp. 63, figs. 159*).—This is a booklet of practical information intended for the farmer and rural contractor, covering the construction of general farm barns, hog houses, cribs and granaries, poultry houses, fences, homes, miscellaneous farm buildings, and handy devices.

Community hog houses, J. B. DAVIDSON, J. M. EVVARD, and W. G. KAISER (*Iowa Sta. Bul. 166 (1916), pp. 406–458, figs. 42*).—This bulletin enumerates the essential features of an ideal hog house and the advantages and disadvantages of the community type of hog house, and describes and illustrates the construction of two successful types of community hog houses, namely, the "Iowa sunlit community hog house" and the "semi-monitor roof house".

The distinguishing features of the Iowa sunlit community hog house are the location of the windows in the roof, thus furnishing direct sunlight to all parts of the house, and low walls used with the idea of reducing cost of construction.

The distinguishing feature of the half-monitor roof hog house is the arrangement and location of the windows. "A row of vertical windows is provided for lighting each of the two rows of pens. The house extends with the long axis east and west, and is not at all adapted to any other direction. When the windows are placed at the right height, direct sunlight will shine into both rows of pens at the same time. If plenty of windows are provided, the pens will be quite thoroughly lighted."

A previous bulletin by Evvard and Davidson dealt with movable hog houses (E. S. R., 32, p. 284).

Water supply for the country home, M. K. SNYDER (*Wash. State Col., Dept. Ext. Bul. 11 (1916), pp. 62, figs. 27*).—This bulletin deals with the sanitary aspects of farm water supplies, purification of farm water supplies, and small water supply systems.

With reference to source, farm water supplies are divided into rain, surface, spring, and ground waters. The usual precautionary statements regarding the protection of wells and springs are given. With reference to the safe distance from pollution for wells it is stated that "if the earth is reasonably uniform, without any well-defined channels along which the water passes, the safety distance is from 75 to 100 ft. above the source of pollution to from 200 to 250 ft. below the source. If there are well-defined channels in the earth, no distance below the source of pollution is safe."

Water purification by mechanical and chemical treatment is discussed and the doubtful utility of small faucet filters pointed out. With reference to small sand filters, it is stated that "the sand layer, at the time of construction, should not be less than about 3 ft. deep and depths greater than 5 ft. are costly

without giving added safety. The water should be kept at a depth of 2 ft. or more over the top of the sand so that the surface of the sand will not be disturbed by any possible currents from the entering water or from other sources. . . . The best results are obtained by using for the filter sand a sand that will pass through a screen having about 20 meshes to the inch, and will not pass a screen having 50 meshes to the inch. . . . The rate of operation should be about 50 gals. per square foot per day." Chemical treatment by use of calcium hypochlorite and quicklime is also described.

The discussion of water supply systems includes descriptions of centrifugal, plunger, and air-lift pumps and hydraulic rams. It is concluded that "if pumping is done by hand from a well of any considerable depth, the cylinder must be of small diameter and the discharge will be correspondingly small. Even when a windmill is used in direct connection with a pump, it is best to use a cylinder of small diameter so that the mill will pump with light winds (8 to 12 miles per hour). But when a gasoline engine or an electric motor is used the power is supplied at a constant rate and the pump should be selected to use this power. This allows the selection of a pump with larger cylinder and consequently less time is required to do the pumping."

Cost data are also included.

House heating, J. L. Mowry (*Univ. Minn., Dept. Agr., Ext. Bul. 60 (1916), pp. 15, figs. 21*).—This pamphlet deals with the general proposition of house heating and describes the stove, hot-air, hot-water, and combination hot-water and hot-air systems, giving hints on installation and automatic control.

RURAL ECONOMICS.

Rural economy in New England at the beginning of the nineteenth century, P. W. Bidwell (*Trans. Conn. Acad. Arts and Sci., 20 (1916), pp. 243–399*).—The author has classified the changes in the rural economy in New England into three periods as follows:

"(1) The period of self-sufficient economy, which had existed since the settlement of the country, reaching the highest point of its development at the beginning of the nineteenth century, a period in which the characteristic features of rural economy were the absence of any market for farm produce and the consequent dependence of each town and, to a large extent, of each household, even, on its own resources for the satisfaction of its wants; (2) the period of transition to commercial agriculture, under the stimulus accorded by the rise of manufacturing enterprises in inland towns and villages and the consequent demand for food and raw materials on the part of the newly arisen nonagricultural population, the years included in this period being approximately the two generations from 1810 down to the close of the Civil War; and (3) the period of decadence of New England agriculture, extending from the close of the Civil War to the end of the nineteenth century, a period in which the increasing pressure of Western competition caused the abandonment of large numbers of New England farms and a decline in both the quantity and quality of the rural population."

The author presents a survey of the rural economic conditions in Massachusetts, Connecticut, and Rhode Island at the close of the first period under the following chapter headings: The inland towns and their village settlements, the coast and river towns, commercial relations of southern New England with the Southern States and the West Indies, internal trade and the transportation system, the agricultural industry, and home and community life in the inland town. A brief bibliography is appended.

A rural survey of Morgan County, Missouri, W. L. Nelson and M. W. Witten (*Missouri Bd. Agr. Mo. Bul., 14 (1916), No. 2, pp. 51, figs. 35*).—This bulletin summarizes replies received from public-school teachers and children, relative to farming conditions within the county, the condition of the rural schools, farmhouses, and the types of farming and of other rural industries.

[Farming and farm labor conditions in North Carolina] (*Ann. Rpt. Dept. Labor and Print. N. C., 29 (1915), pp. 16–29*).—These pages give by counties the condition of the land, tendencies regarding the size of farms and diversifications, wages paid, the cost of producing the principal farm crops, and the condition of the roads, education, and finances.

List of farms for sale, 1915 (*Hartford, Conn.: Bd. Agr., 1915, pp. 157, figs. 17*).—This bulletin brings up to date for 1915 the list previously noted (E. S. R., 32, p. 390) of farms for sale in Connecticut.

Farms for sale or rent in New York, 1916, C. W. Larmon (*N. Y. Dept. Agr. Bul. 78 (1916), pp. 425–624, pls. 44*).—This bulletin brings up to date for 1916 the list previously noted (E. S. R., 33, p. 490).

Pennsylvania farms for sale (*Penn. Dept. Agr. Bul. 273 (1916), pp. 106, pl. 1*).—This bulletin contains a compilation of the farms in Pennsylvania offered for sale, and gives a detailed description of the land, buildings, water supply, and distances from the railroad station, post office, and churches, together with the price asked.

Statistics and agriculture, R. Kindler (*Mitt. Deut. Landw. Gesell., 31 (1916), No. 4, pp. 46–54*).—In this article are discussed the various types of statistical reports relating to agriculture, methods of reporting, and the general tendency of agricultural production in Germany as revealed by her agricultural statistics.

The rural life of Japan (*Tokyo, Japan: Bur. Local Affairs, 1914, pp. 111+51, pls. 8*).—This book contains a number of typical instances illustrating the industrial and moral spirit of the farming classes and the influence of the authorities and leaders in building up an ideal type of rural people.

Farm contracts between landlord and tenant, W. C. Tichenor (*Lebanon, Ohio: Author, 1916, pp. XII+245*).—This book outlines the different types of contracts that are in common practice between landlord and tenant, and the subjects of agreement arising in farm leases and the law pertaining to them. Copies of a number of lease contracts are included.

Amortization methods for farm mortgage loans, L. E. Truesdell and C. W. Thompson (*U. S. Dept. Agr., Office Sec. Circ. 60 (1916), pp. 12*).—This circular describes different methods of computing payments of mortgages by the amortization plan. Detailed tables are given showing the amount of payment necessary with the variation in interest and length of time for repayment by the various methods described.

Farm credit problems in Wisconsin (*Wisconsin Sta. Bul. 268 (1916), pp. 32–34, fig. 1*).—These pages contain a brief statement concerning the farm credit investigations of B. H. Hibbard, the results of which are given in detail in a bulletin previously noted (E. S. R., 32, p. 892).

Annual report on the working of cooperative societies in the Bombay Presidency, 1915 (*Ann. Rpt. Work. Coop. Soc. Bombay Pres., 1914–15, pp. 3+71+5*).—This report continues data previously noted (E. S. R., 32, p. 593.)

Economic effect of cold storage upon the average price of eggs, B. Groesbeck and F. G. Urner (*New York: Joint Com. Cold Storage Warehousemen and Affiliated Indus. [1916], pp. 10, pl. 1*).—The authors have summarized their conclusions as follows:

"The per capita consumption of eggs at New York has increased largely since ample cold storage facilities became available.

"Considering differences in the quality of the eggs quoted there has been no considerable advance in wholesale values of fresh-gathered eggs, either during the season of flush or of short production, in the period 1900–1910 as compared with a similar period before cold storage was available.

"The average prices of fresh gathered and storage eggs taken together were lower during the season of scarcity in the period since cold storage has been available than were the prices for fresh-gathered eggs before cold storage was available, notwithstanding a well-known advance in the prices of nearly all commodities during the decade, beginning 1900.

"Accumulations of eggs in cold storage during the season of excess production are practically exhausted before the next season of flush begins.

"The ability to carry eggs in cold storage from the period of greatest production throughout the later period of shortage greatly increases the opportunity for profitable production without enhancing the average prices and adds to the food supply."

Monthly crop report (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), No. 6, pp. 49–60, fig. 1*).—This number contains the usual data regarding the range of prices at important markets, average price paid to producer, and estimated farm values on May 15; together with data concerning the acreage in watermelons and cantaloups in 1915 and 1916 and the percentage of the crop harvested in each month, the condition on June 1 of the truck crops and the principal agricultural crops, and the estimated annual supply of potatoes in the United States.

A special report on long-staple cottons is included, indicating that 7.4 per cent of the total crop is of long-staple variety, which in an ordinary season amounts to approximately 825,000 bales. According to this report, of the cotton produced in the principal cotton-producing States, the following percentages of the total are long-staple varieties: Arizona, 90; Mississippi, 23; Missouri, 20; California, 20; Arkansas, 14.4; and Oklahoma, 13.5. There is also included a special article by O. F. Cook on The New Long-Staple Cottons.

A recent statement issued by the U. S. Bureau of the Census regarding the manufacture of wagons and carriages is cited which indicates that the number of carriages manufactured in 1914 was 34 per cent less than in 1909 and the number of wagons 9 per cent less.

A special inquiry regarding the months in which hogs are slaughtered on farms shows that 32.1 per cent are slaughtered in December, 20.3 per cent in January, and 19.5 per cent in November; that is, practically 72 per cent of the hogs slaughtered on farms are slaughtered during these three months.

Acreage and live stock returns of England and Wales (*Bd. Agr. and Fisheries [London], Agr. Statis., 50 (1915), No. 1, pp. 75*).—This report continues data previously noted (E. S. R., 33, p. 789).

[Agricultural statistics of Hungary] (*Ungar. Statis. Jahrb., n. ser., 21 (1913), pp. 73–119*).—These pages continue data previously noted (E. S. R., 34, p. 596).

[Agricultural statistics in Switzerland] (*Statis. Jahrb. Schweiz, 23 (1914), pp. 54–65*).—These pages continue data previously noted (E. S. R., 33, p. 193).

Agricultural statistics of British India (*Statis. Abs. Brit. India, 49 (1904–5—1913–14), pp. 126–135*).—This report continues data previously noted (E. S. R., 33, p. 295).

Statistical returns of crops in Southern Rhodesia, 1914–15, E. A. Nobbs and B. Haslewood (*Rhodesia Agr. Jour., 13 (1916), No. 1, pp. 28–44*).—These pages contain a general description of the condition of agriculture in Southern Rhodesia, together with statistical data showing the area under crops, the total yields, the amount of silage, and the area of irrigated lands, with sources of water supply.

AGRICULTURAL EDUCATION.

Report of committee on graduate work in horticulture, M. J. Dorsey (*Proc. Soc. Hort. Sci., 12 (1915), pp. 74–87*).—This survey of the present status of graduate work in horticulture is divided into three main heads, viz, (1) the teaching and research staff, (2) the material equipment, such as laboratory, library, orchard, etc., and (3) the product, or type of training given.

The staff is discussed from the standpoint of training, freedom of time, and specialization. A table comparing the formal degrees of the horticultural workers of 1915 with those of 1905 shows that there is a noticeable increase in the group of associates in the 10-year period, a relatively large decrease in the number of horticultural workers holding no degree, and in 1915 a relatively larger number of workers with only a bachelor's degree. Another table, comparing the formal degrees of the horticultural staff in 16 of the larger institutions giving graduate work in horticulture with those of the staff in the department of chemistry, calls attention to the larger number of workers in the chemistry group of the rank of instructor and assistant holding advanced degrees, and the larger number of heads of departments with the doctorate degree, suggesting the probable influence of this advanced training upon the standards of undergraduate as well as graduate instruction and departmental leadership. The committee considers specialization as one of the most effective means of increasing efficiency in the staff as well as giving a larger freedom of time. The exchange arrangement between Cornell and Wisconsin universities and the cooperative arrangement between the horticultural department of the West Virginia University and the department of plant physiology of the University of Chicago are mentioned as among significant recent movements toward giving instructors a broader experience and viewpoint.

The investigation of the product, or type of training given, reveals the facts that there are 9 institutions offering work in horticulture leading to the doctor's degree and approximately 20 scheduling work for the master's degree. The time required is uniformly one year's residence or the equivalent for the master's degree. The departments of horticulture offering work for the doctor's degree come under the control, in every case, of well-organized graduate schools, and the standardization of requirements for advanced degrees is well taken care of by other agencies, the uniform requirements for this degree being three years' residence in advanced work, as a minimum while research in one minor in some related field is generally required. At the present time there are registered 10 students for the doctor's degree in horticulture and 77 for the master's degree, exclusive of those at the Pennsylvania, Virginia, Massachusetts, or New Jersey colleges. Graduate courses in pomology are scheduled in 13 institutions, in olericulture in 9, in landscape gardening in 5, in floriculture in 6, and in plant breeding in 8, while 5 list their graduate work under thesis research. In the last five years there have been 84 theses in horticulture submitted, 19 States only being represented. An analysis of the subjects, practically all of which are for the master's degree, shows that 51 could be classified under pomology, 10 under plant breeding, 4 under olericulture, and 1 under landscape gardening. Nearly all of the institutions offering graduate work have assistantships or fellowships, varying in amounts from $100 to $1,000 a year, available in the department of horticulture. Extracts from letters are included setting forth the principles involved in residence credit for graduate assistants.

Report of committee on floriculture, E. A. White (*Proc. Soc. Hort. Sci., 12 (1915), pp. 111–113*).—The committee reports as to (1) the provision of better facilities for teaching floriculture, including new ranges at the Ohio and Indiana universities and the Iowa College, and extensive additions to

glass-house areas for teaching at the Illinois and Cornell universities, (2) the strengthening of courses and the marked improvement in the nature of the work given, and (3) the publication by the chairman of the committee of a text entitled Principles of Floriculture to meet the needs of smaller institutions where only a general course in floriculture is given in connection with other horticultural courses.

In institutions where there are special courses in floriculture the committee considers the lecture system, supplemented by required outside reading, the best method of instruction. It emphasizes the importance of requiring students intending to specialize first to have a knowledge of chemistry, soils, and fertilizers, and also botany in all its phases, especially in plant physiology and pathology. It considers business training an essential and a certain amount of farm practice as leading to greater efficiency, and is of the opinion that practical experience in floriculture can be secured nowhere better than in an up-to-date commercial range under the supervision of a broad-minded practical floriculturist.

Organization and methods for pomology extension work, R. W. REES (*Proc. Soc. Hort. Sci., 12 (1915), pp. 63-68*).—The author outlines the development of pomology extension work and methods that have proved successful at the Massachusetts College. He believes that the "principle of close relationship and mutual understanding between the extension service, the experiment station, and the college is necessary for successful development. All extension work should be outlined in form of definite projects so efforts may be concentrated on the most essential problems. With the rapid development of the agricultural county farm bureaus the extension work in each county should be conducted in cooperation with the agricultural agents. In counties which have a pomologist, the work should be largely carried on by him under general supervision of the extension pomologist at the college."

Agricultural instruction in Prussia, E. VITAL (*Wiener Landw. Ztg., 65 (1915), Nos. 93, p. 688; 94, pp. 693, 694*).—This is a review of the development and present status of agricultural instruction in Prussia.

Yearbook of the Department of Agriculture, Industries, and Commerce in the Dutch East Indies, 1914 (*Jaarb. Dept. Landb. Nijv. en Handel Nederland. Indië, 1914, pp. VI+331, pls. 16*).—This is a report of the Department of Agriculture, Industries, and Commerce, including its activities in promoting agricultural instruction and research in 1914, in the Dutch East Indies.

Preliminary suggestions for agriculture, domestic science, and manual training for elementary grades and high schools (*Des Moines: Dept. Pub. Instr., 1915, 2. ed., pp. 21*).—This bulletin outlines the minimum requirements of the Iowa law as to the amount of agriculture, domestic science, and manual training that must be taught, the grades in which the subjects shall be offered, the teaching force needed, the preparation in these subjects required of teachers, and the special rooms, apparatus, and equipment necessary.

Helps for teachers of agriculture, January-April (*Dept. Pub. Instr. [Ind.], Ed. Pubs., Bul. 12 (1915), pp. 30*).—This portion of the bulletin outlines the second four months' work in soils and poultry, horticulture and dairying, and animal husbandry and farm crops, continuing previous work (E. S. R., 32, p. 597).

Correspondence courses in agriculture for teachers. Course I, farm plants and soils (*Corresp. Courses Teachers [Iowa], Agr. Ext. Dept., Course I, Farm Plants and Soils, Assigns. 5, pp. 21, figs. 15; 6, pp. 23, figs. 8; 7, pp. 24, figs. 4; 8, pp. 22, figs. 7; 9, pp. 23, figs. 4; 10, pp. 24, figs. 4; 11, pp. 24, figs. 8; 12, pp. 24, figs. 9; 13, pp. 24, figs. 9; 14, pp. 24, fig. 1; 15, pp. 28, figs. 14; 16, pp. 35,*

figs. 29; 17, pp. 18, fig. 1; 18, pp. 21, fig. 1).—These bulletins comprise lessons, prepared for the purpose of giving teachers in the rural and graded schools of Iowa a sufficient knowledge of agriculture to meet the requirements of the school law and of supplying outlines showing what to teach and how the material can best be presented. The lessons deal with the cultivation, history, distribution, improvement, varieties, etc., of the principal grain crops, the cultivation of potatoes, the home garden, fruit growing, trees on the farm, planning and planting the farmstead, legumes, forage crops, plant diseases and injurious and beneficial insects, weeds, fertilizers, and crop rotations.

Productive farm crops, E. G. MONTGOMERY (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. XIX+501, pl. 1, figs. 205*).—This book was written to meet the needs of students having some practical knowledge of crop production in agricultural short courses and secondary schools and of beginners in agricultural colleges. Because of its practical nature it may also be used as a handy reference book for farmers. The author has endeavored to develop the fundamental principles of crop production as demonstrated by practical experience, dealing with the classification, origin, distribution, growth, cultivation, insects and diseases, harvesting, and utilization of field crops in general as well as of individual crops. Practical exercises and review questions are included in each chapter. Data as to local weeds, market grades of hay and straw, and grades of grain are appended.

The small grains, M. A. CARLETON (*New York: The Macmillan Co., 1916, pp. XXXII+699, pl. 1, figs. 183*).—This book is intended primarily for instruction in colleges and universities, but is also adapted for use in agricultural short courses, in academies and high schools, and by farmers and general readers. After a brief discussion of the fundamental principles of plant structure and nutrition, as related to cereals, the four principal cereals are treated separately and from the individual plant standpoint as to their origin, characteristics, classification, varieties, selection, and hybridization. Then, to avoid duplication, these cereals are treated together with reference to the further subjects of soil and climatic relations, acclimatization, cultivation, irrigation, weeds, insect and fungus pests, and uses. Buckwheat and rice, being botanically different from the four cereals referred to, are treated separately as to all topics. An extended bibliography is appended.

Corn and cotton, edited by C. A. McMURRY (*Peabody Col. Bul., 1 (1915), No. 2, pp. 48*).—This pamphlet contains studies of the history, production, improvement, and uses of corn and cotton, the marketing and manufacture of the latter, competition in the manufacture of cotton goods, and references to literature on these subjects. The pamphlet is designed for the use of teachers and includes suggestions on methods, but is simple enough to be used by children as a text.

Weeds, L. G. ATHERTON (*Normal Teacher [Madison, S. Dak.], 5 (1915), No. 6, pp. 31, figs. 13*).—This is a suggestive outline for the use of teachers in the introduction of the study of weeds in rural and village schools.

Laboratory manual in general microbiology, W. GILTNER ET AL. (*New York: John Wiley and Sons, 1916, pp. XVI+418, pl. 1, figs. 97*).—This laboratory guide is based on the work of instructors at the Michigan College for over a decade and consists of three parts. The purpose of part 1 is primarily to give a working knowledge of laboratory methods used in the study of microorganisms, molds, yeasts, and bacteria being taken up in the order of their comparative size and studied as to their identification by morphological and cultural methods; part 2 consists of exercises demonstrating the various physiological activities of micro-organisms; and part 3 deals with applied microbiology. An appendix contains an outline for the study of microbiology, data on media, solutions, stains, etc., and a list of text and reference books.

Instructions for collecting and preserving valuable Lepidoptera for scientific purposes, J. SINCLAIR (*Los Angeles, Cal.: Author, 1916, pp. 80, figs. 61*).—The instructions, given in simple language and avoiding technical terms, are followed by cuts and descriptions of valuable butterflies and moths, as well as of a number of common ones which are very similar to them in appearance.

Poultry study for schools, J. W. HUNGATE (*Dept. Agr. State Normal School [Cheney, Wash.], Bul. A, No. 5 (1916), pp. 19, figs. 7*).—The author discusses the value of poultry study, poultry growing as a school project, teaching poultry raising to school children through clubs, poultry enemies, and the prevention of diseases, and outlines 12 exercises. A list of reference books is added.

Outlines in home economics, NEALE S. KNOWLES (*Dept. Pub. Instr. Iowa Circ. 4 (1915), pp. 95, pls. 6, figs. 3*).—The author outlines a half-year course, consisting of 90 lessons, in home economics for high schools. Five periods a week are to be devoted to the work, viz, two lecture periods and one sewing period of 45 minutes each, and at least two laboratory periods of 90 minutes each. Lists of individual and class equipment and references to literature are included.

Outline of domestic art work for the high school with bibliography, MARTHA PATTERSON (*Ala. Girls Tech. Inst. Bul., n. ser., No. 31 (1915), pp. 34*).—These outlines in domestic art work are not intended as a course of study, but simply to furnish classified topics of fundamental work from which courses can be organized. Extended annotated bibliographies on domestic art and domestic science, the latter compiled by Louisa J. Keys, are included, together with lists of illustrative material and its sources.

Home projects for agriculture and home economics, MRS. E. M. BARRETT (*Texas Dept. Agr. Bul. 47 [1916], pp. 32*).—This bulletin contains programs, rules, and regulations for and contests in a number of home projects, rules of the home credit system, a constitution and by-laws for the junior farmers' institute, and a list of free bulletins to be used in home project work.

Course ˙ school-home projects, 1916 (*Chicago: Co. Supt. Schools, 1916, pp. 15*).—This pamphlet gives general directions for school-home project work, and outlines courses in field and garden, business, cooking and sewing, poultry, music, and cow testing school-home projects for the pupils over 10 years of age in the public schools of Cook County, Ill., all of whom now take a course in school-home projects as a part of their regular school work.

A first book of school gardening, A. LOGAN (*London: Macmillan and Co. Ltd., 1915, pp. VII+151, figs. 58*).—The aim of this book is to instruct pupils between the ages of 12 and 16 in the fundamental principles of soil management and plant growth and to provide practical instruction through the school garden. Review questions and practical exercises are added to each chapter.

School gardens (*Agr. Gaz. Canada, 3 (1916), No. 2, pp. 158–176, figs. 14*).—Brief reports are given on the progress of school and home garden work in the Provinces of Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

School fairs (*Agr. Gaz. Canada, 3 (1916), No. 1, pp. 77–88, figs. 3*).—This is a series of reports on the progress of the school-fair movement in the Provinces of Nova Scotia, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia.

MISCELLANEOUS.

Twenty-sixth Annual Report of Arizona Station, 1915 (*Arizona Sta. Rpt. 1915, pp. 505–581, pl. 1, figs. 12*).—This contains the organization list, an administrative report by the director on the work and publications of the station, a

financial statement for the fiscal year ended June 30, 1915, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue. A brief report on the work and expenditures of the college of agriculture is appended.

Report of Hawaii Station, 1915 (*Hawaii Sta. Rpt. 1915, pp. 73, pls. 9*).—This contains the organization list, a summary by the agronomist in charge as to the work of the year, and reports of the departments of horticulture, entomology, chemistry, and agronomy, the extension division, and the Glenwood substation. The experimental work recorded is for the most part abstracted elsewhere in this issue, as is also a special report of horticultural observations in Porto Rico, Cuba, and Florida.

Thirty-eighth Annual Report of North Carolina Station, 1915 (*North Carolina Sta. Rpt. 1915, pp. 5-43+111, figs. 23*).—This contains the organization list, a report of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1915, and reprints of Bulletins 228–231, previously noted.

Report of the Hood River, Oregon, Branch Experiment Station, 1915 (*Oregon Sta., Rpt. Hood River Sta., 1915, pp. 61, pl. 1, figs. 14*).—A report is given of the work of the year, the experimental features recorded being for the most part abstracted elsewhere in this issue.

Annual Report of Pennsylvania Station, 1914 (*Pennsylvania Sta. Rpt. 1914, pp. 522, pls. 73*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1914, a report of the director on the work and publications of the station during the year, departmental reports, many special articles abstracted elsewhere in this issue, and reprints of Bulletins 128 and 133, previously noted.

Report of the director, 1915, H. L. RUSSELL (*Wisconsin Sta. Bul. 268 (1916), pp. 82, figs. 47*).—This contains the organization list, a report of the work of the station during the year, portions of which are abstracted elsewhere in this issue, brief summaries of the publications of the year, and a financial statement for the federal funds for the fiscal year ended June 30, 1915.

Monthly Bulletin of the Ohio Agricultural Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916), Nos. 6, pp. 161–192, figs. 6; 7, pp. 193–224, figs. 11*).—These numbers contain, in addition to several articles abstracted elsewhere in this issue, the following:

No. 6.—Variety *v.* Simple Rations for Laying Hens, by W. J. Buss, an extract from Bulletin 291 (E. S. R., 35, p. 171); Potato Insurance, by D. C. Babcock; and The Mineral Requirements of the Milch Cow, by E. B. Forbes, an extract from Bulletin 295 (E. S. R., 35, p. 481).

No. 7.—Variety Tests of Wheat, by C. G. Williams, an extract from Bulletin 298 (see p. 534); and Forage Crops for Swine, by W. L. Robison, adapted from Bulletins 242 and 268 (E. S. R., 28, p. 468; 31, p. 868).

In memoriam: Eugene Woldemar Hilgard (*Berkeley, Cal.: Univ. Cal. Press, 1916, pp. 50, pls. 2*).—This includes the addresses at the memorial services held at the University of California, January 30, 1916; a reprint of an editorial from *Experiment Station Record* (E. S. R., 34, p. 301); and a bibliography of Dr. Hilgard's publications.

NOTES.

Arizona University.—Stanley F. Morse, superintendent of the extension service, has resigned to become superintendent of a large commercial guayule plantation near Tucson.

Delaware College and Station.—M. L. Nichols has been appointed assistant professor of agronomy and assistant agronomist, vice W. A. Lintner whose resignation has been previously noted.

Georgia Station.—The building of two additional offices and laboratories to house the agronomist and assistant chemist has been authorized. The work is to be begun at once, as well as other improvements in the buildings and grounds.

Director R. J. H. DeLoach resigned November 1 to organize and direct a bureau of research and education connected with a commercial concern in Chicago. James D. Price, State Commissioner of Agriculture, has been appointed director beginning January 1, 1917. H. P. Stuckey will be acting director until that time.

Idaho University and Station.—Two new silos have been completed for testing new crops in feeding cattle and sheep, making five in use. In addition, 13 wood stave silos of ¾ ton capacity are to be devoted to a study of the fermentation processes of silage and of the use of crops other than corn.

Julius E. Nordby has been appointed instructor in animal husbandry and farm superintendent.

Illinois University and Station.—W. I. Brockson has been appointed assistant in crop production.

Purdue University and Station.—R. S. Stephenson has been appointed instructor in animal husbandry and W. B. Krueck and J. B. Markey assistants in animal husbandry in the college of agriculture, and George Cross assistant in animal husbandry in the station. Charles S. Brewster has been appointed instructor in poultry husbandry. P. S. Richey has succeeded P. E. Thompson, resigned, as assistant in animal husbandry.

Kentucky University and Station.—Dr. J. H. Kastle, dean of the college of agriculture and director of the station, died September 24 after a brief illness.

Dr. Kastle was born January 25, 1864, at Lexington, Ky., and was graduated from the Kentucky State College in 1884. He received the master's degree two years later from the same institution, and in 1888 that of Ph. D. from Johns Hopkins University. He then returned to Lexington as professor of chemistry, serving in this capacity for 17 years. In 1905 he became chief of the division of chemistry in the Hygienic Laboratory of the U. S. Public Health and Marine Hospital Service, and from 1909 to 1911 served as professor of chemistry in the University of Virginia.

Dr. Kastle was appointed research chemist in the Kentucky Station in 1911, and upon the death of Dean Scovell the following year succeeded him as dean and director. He was a member of the American Chemical Society, the Society of Biological Chemists, the American Physiological Society, and the Society of Chemical Industry, and the author of a long list of publications, mainly in biological and physiological chemistry. When taken sick he was preparing a paper on The Relations of the Experiment Station to Regulatory Work for

the November meeting of the Association of American Agricultural Colleges and Experiment Stations. He was a man of broad vision, marked originality, and clear thinking, and had rendered distinguished service in the fields of research, education, and administration.

George Roberts, head of the department of agronomy, has been appointed acting dean of the college of agriculture and Dr. A. M. Peter acting director of the station.

The department of home economics was separated in September from the college of agriculture as the college of home economics, with Mary E. Sweeny as dean. James Wright Wesson has been appointed assistant in agricultural economics and G. M. Roach inspector in the food and drug department, both appointments taking effect in September.

Missouri Station.—F. L. Bentley has resigned as assistant in animal husbandry to become instructor in animal husbandry at the Pennsylvania College, and has been succeeded by C. W. Sheppard, a 1916 graduate of the college of agriculture.

Nebraska University and Station.—H. E. Vasey, assistant professor of agricultural botany and assistant agricultural botanist, resigned September 1 to become instructor in botany at the Colorado College and assistant botanist in that station.

New Hampshire College.—J. M. Fuller, head of the dairy department of the Oklahoma College and Station, has been appointed professor of dairying, vice F. Rasmussen, resigned to accept a similar position at the Pennsylvania College. Miss Helen Knowlton, of Cornell University, has been appointed professor of home economics and dean of women.

Ohio State University and Station.—William R. Lazenby, associated with the university since 1881 and one of the pioneer educators in horticulture, died September 15, at the age of 66 years. Professor Lazenby was graduated from Cornell University in 1874 and served there as instructor in horticulture and botany until 1878, and as assistant professor until 1881. At Ohio he was professor of botany and horticulture until 1892, then professor of horticulture and forestry until 1909, and since that date professor of forestry.

Professor Lazenby was also one of the founders of the Ohio Station, serving as its first director from 1882 to 1886, and then as vice director until his removal to Wooster in 1888. He was a member of a large number of scientific organizations, among them the American Association for the Advancement of Science, of which he was a fellow and vice-president in 1896; the Society for the Promotion of Agricultural Science, of which he was secretary from 1886 to 1891 and president from 1895 to 1897; the American Forestry Association; and the American Pomological Society, of which he had been vice-president for several years.

Arthur Huisken has been appointed assistant in soils in the station.

Porto Rico Insular Station.—R. C. Rose has been appointed assistant pathologist beginning September 14.

Vermont University.—M. C. Wilson has resigned as farm management demonstrator of New Hampshire and Vermont to become state leader of county agents in New Hampshire. He has been succeeded by Walter G. Tubbs, a 1916 graduate of Cornell University, who will give his entire time to work in Vermont.

Virginia Truck Station.—J. T. Rosa, instructor in truck crops at the Iowa College, has been appointed assistant horticulturist beginning October 1.

Honduras Experimental Station.—A tract of land owned by the State on the Carretara del Sur, about five miles from Tegucigalpa, is being developed for

experimental purposes. The buildings are being remodeled and it is hoped eventually to maintain a complete experiment station and agricultural school. The work at present under way is largely of a preliminary nature with various crops.

Federal Agricultural Legislation.—In addition to the legislation already noted (E. S. R., 35, pp. 101, 200, and 301) a number of other provisions of agricultural and educational interest were adopted at the opening session of the Sixty-fourth Congress.

The act making appropriations for the support of the army establishes a council of National Defense consisting of the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. This council is to supervise and direct investigations and make recommendations, not only as to purely military measures but as to the increase of domestic production of articles and materials essential to the support of armies and of the people during an interruption of foreign commerce and similar matters. It is also to nominate to the President for his appointment an advisory commission of not more than seven persons, each of whom has special knowledge of some industry, public utility, or the development of some national resource. An appropriation of $200,000 is provided for experimental work undertaken by the council, the advisory commission, or subordinate bodies, for carrying on the work provided.

A section in the National Defense Act of June 3, 1916, provides that soldiers in active service shall hereafter be given opportunity to receive instruction along vocational lines. Civilian teachers may be employed to aid the army officers in giving this instruction, which may include training in agriculture.

Under a provision in the Indian appropriation act, a farmer or expert farmer appointed in the Indian Service after January 1, 1917, and receiving at least $50 per month, must procure certificates of competency showing that he is a farmer of actual experience and qualified to instruct others in the art of practical agriculture. These certificates are to be issued by the president or dean of the agricultural college of the State in which his services are to be rendered or by the corresponding official of the college in an adjoining State.

The Postmaster General is authorized in the appropriation act for the support of his Department to conduct experiments in three or more communities for the purpose of determining the most practical means of extending the operations of the parcel post in promoting the marketing of products and furthering direct transactions between producers and consumers. An appropriation of $10,000 is made for this purpose.

A law which establishes standards for the so-called Climax baskets for grapes and other fruits and vegetables and for other types of baskets and containers used for small fruits, berries, and vegetables becomes effective November 1, 1917. Standards of 2, 4, and 12 quarts dry measure are provided for the Climax or "grape" baskets, while other containers are restricted in size to ½ pint, 1 pint, 1 quart, and multiples of 1 quart dry measure. Penalties are prescribed for shipments in interstate commerce which do not conform to these requirements. The Secretary of Agriculture is to establish rules and regulations and to examine containers to determine their compliance with the act.

A standard "large barrel" of 280 pounds net and a "small barrel" of 180 pounds net are established for lime. All lime handled in interstate commerce in barrels must be packed in barrels of these sizes or a fractional part of the small barrel. Rules and regulations are to be prescribed by the Bureau of Standards and approved by the Secretary of Commerce. Penalties are provided for violations, beginning January 1, 1917.

Military Legislation Affecting the Land-grant Colleges.—Under the National Defense Act, the President is authorized to establish and maintain reserve officers' training corps at certain civil educational institutions. Universities and colleges requiring four years of collegiate study for a degree and at which instruction in military tactics is provided under the Morrill Act are grouped under what is known as the senior division of this corps, and each state institution may constitute one or more units of the corps if enrolling under military instruction at least 100 physically fit male students.

The Secretary of War is authorized to prescribe a course of theoretical and practical training for the units of the corps, this to include senior instruction and an average of at least three hours per week per year for the entire course. Provision is made whereby additional officers, noncommissioned officers, and enlisted men may be detailed from the regular army for service at these institutions, animals, arms, uniforms, equipment, and transportation may be supplied as needed, and field camps may be maintained.

Members of the corps who have completed two academic years of service and care to continue the course may be supplied by the United States with commutation of subsistence for the remainder of their course. Graduates up to a total of 50,000, who agree to serve at least ten years as reserve officers, may be so appointed, and any reserve officer thus appointed may be commissioned as a temporary second lieutenant of the regular army for not to exceed six months with pay of $100 per month and the usual allowances. Graduates between 21 and 27 years of age who, prior to the passage of the act, have received the requisite training may also be appointed temporary second lieutenants and reserve officers.

Another law increases the number of cadets at the U. S. Military Academy. This law provides that 20 cadets are hereafter to be appointed by the President from the honor graduates of educational institutions having officers of the regular army detailed as professors of military science and tactics under the existing law.

A third act provides for the issue of Government supplies to these institutions for the establishment and maintenance of military instruction camps.

National Research Council.—Following a request from President Wilson, the National Academy of Sciences has organized a National Research Council. The purpose in view is stated to be to bring " into cooperation existing governmental, educational, industrial, and other research organizations, with the object of encouraging the investigation of natural phenomena, the increased use of scientific research in the development of American industries, the employment of scientific methods in strengthening the national defense, and such other applications of science as will promote the national security and welfare."

The membership is to include American investigators and engineers, representing the army and navy, the various scientific bureaus of the Departments and the Smithsonian Institution, educational institutions and research endowments, and the research divisions of industrial and manufacturing establishments. Dr. George E. Hale, director of the Mt. Wilson Solar Observatory, has been chosen chairman, and Dr. Raymond Pearl, of the Maine Experiment Station, a member of the executive committee. Committees have also been appointed on research in educational institutions, the promotion of industrial research, and a national census of research.

Agricultural Education and the European War.—According to a statement in the *London Times*, Mr. F. D. Acland, secretary of the British Board of Agriculture and Fisheries, recently stated in the House of Commons that the scheme of agricultural education had been retarded by the war, but that the popularity of agricultural education had undoubtedly increased and that

there had been real progress in the use made by farmers of the facilities offered. He "sincerely believed that no previous expenditure of money had helped us in this war more than that which had been spent in agricultural education."

Necrology.—Dr. Albert J. Cook, State Horticultural Commissioner of California since 1911, died September 29 at the age of 74 years. Dr. Cook was an early graduate of the Michigan Agricultural College, receiving the bachelor's degree in 1862 and the master's degree in 1864, as well as that of doctor of science in 1905. He also studied at Harvard University in 1867 and 1868.

Dr. Cook began his long career at the Michigan College in 1867 as instructor in mathematics. From 1868 to 1893 he was professor of zoology and entomology, as well as curator of the museum from 1875 to 1893 and entomologist in the Michigan Station from 1888 to 1891. He was professor of biology in Pomona College from 1893 to 1911. He had also been actively engaged in farmers' institute work in both Michigan and California and in the formation of organizations of citrus growers. He was an early experimenter with insecticides, notably kerosene emulsion in 1877 and the use of arsenites for the control of the codling moth in 1880, and the author of a number of works on bee keeping and other agricultural topics.

Prof. J. A. Portchinsky, the distinguished Russian entomologist died May 21 at the age of 68 years. From 1874 to 1894, Professor Portchinsky was scientific secretary to the Russian Entomological Society, and since 1894 chief of the entomological bureau of the Ministry of Agriculture and chief editor of its memoirs. He was the author of 24 memoirs, besides a large number of other scientific contributions. He was also the Russian reviewer of the *Review of Applied Entomology*. He had traveled extensively over Russia, Caucasia, and Turkestan, and collected a mass of materials on the biology of insects.

Foster E. L. Beal, assistant biologist of the U. S. Department of Agriculture from 1891 to 1901 and subsequently economic ornithologist of the Bureau of Biological Survey, died October 1 at the age of 76 years. Professor Beal was a native of Massachusetts and a graduate of the Massachusetts Institute of Technology in 1871. He had specialized in economic ornithology and was the author of numerous publications on the subject.

New Journals.—*Verslagen en Mededeelingen van de Directie van dem Landbouw* is being published by the Department of Agriculture, Industry, and Commerce of the Netherlands. The initial number contains a history of the appropriations for agriculture in the Netherlands since 1798, an account of the Netherlands cattle trade with foreign countries, a report on agriculture in Great Britain and Ireland and their trade in agricultural products, and a list of the publications of the department from 1904 to 1915.

Boletim Fluminense de Agricultura e Industria is being published by the State of Rio de Janeiro, Brazil, as a means of bringing agricultural information more directly to the attention of farmers. The principal article in the initial number deals with millet.

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U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
A. C. TRUE, DIRECTOR

Vol. 35 NOVEMBER, 1916 No. 7

EXPERIMENT STATION RECORD

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1916

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[a] Printed in scientific and technical publications outside the department.

EXPERIMENT STATION RECORD.

Vol. 35. November, 1916. No. 7.

Nothing in recent years has so emphasized and impressed the real importance of agriculture and agricultural institutions as the war in Europe. It has demonstrated dependence upon this art and has raised it to a preeminent position in the welfare of the country. Ordinarily accepted without much thought or realization by the great body of people, it has suddenly sprung into an importance second only to that of the military activities. It has become, indeed, a recognized field of war service and one of the chief elements in the national defense. Its response, and the resourcefulness and practical value which its institutions have shown, have brought the present position of agriculture close home to the people as never before on so broad a scale.

The problem of maintaining, and in some cases increasing, the production of food for man and beast has been one of the large and difficult ones in the countries at war. It has taxed their skill and organization, and their ability to cooperate in the common good. With thousands of acres devastated, relations with other countries interrupted, and with a vast army of the farmers and laborers on whom production ordinarily rests suddenly become dependent on the labor of others, the necessity of cultivating all available land and making the soil yield its full return became a national concern in all the countries. It inspired unusual measures for stimulating and assisting those who were left on the land, and led to appeals for agricultural workers second only to those for men to fight.

The way in which this extraordinary demand has been met has furnished a new realization of the great advances in every branch of farming. It has entitled agriculture to a regard and consideration which it has not always enjoyed before. If it has not actually raised it to a new position in the lives of nations, intelligent understanding of its position has been greatly broadened.

And along with the rest, this supreme test has furnished an impressive illustration of the great share which agricultural investigation, education, and various forms of instruction have had in placing agriculture on a higher plane of efficiency and in making it more resourceful and adequate. The response of agriculture is in

no small measure a reflection of the steady work of various classes of agricultural institutions and organizations, which has been going on quietly and often with meager support or understanding. The measure of strength of these agencies, and the extent to which there has been some form of agricultural organization to assist, has been a large factor in meeting the unusual situation.

The first efforts in the various countries centered largely on providing the machinery for gathering in and saving the crops, and in this the assistance of the military was furnished to a limited degree. But as time went on the necessity became apparent of providing for the continuance of agriculture on the highest possible plane, of keeping up the fertility of the land, of preventing the depletion of live stock, of avoiding waste of all kinds, and often of discovering and utilizing new sources of supplies. Organized effort was therefore enlarged and increasing latitude extended in the temporary use of soldiers.

The attitude of cooperation between the military and civil authorities is well illustrated by the instructions of the French Minister of Agriculture in transferring to district commanders the assignment of soldiers to agricultural duties. He said: "The regular, prompt, and (as far as possible) complete execution of agricultural work constitutes one of the essential elements of national resistance and consequently one of the principal forces of success. The full use of the soil must be obtained at all costs, equally with the supply of men and material to the army, or the supply of labor to factories engaged in national defense." Soldiers were classified on the basis of farm experience, and opportunity given them to offer themselves for temporary work in the fields. In order to avoid unfavorable reflection upon such, the idea was widely disseminated that soldiers thus volunteering to assist in farm work were not to be regarded as "shirkers" but on the contrary as men doing a double patriotic duty, by fighting and by keeping their brother fighters alive.

In Great Britain the measures and appeals of the government have shown no less appreciation of the importance of agricultural work. Steps were early taken to organize the agricultural forces and to increase the food production. The situation called attention to certain conditions in that country which attempts were made to remedy by a readjustment of the systems of farming, and by organizing systematic means for providing labor and increasing the food returns from the land under cultivation. In directing public attention to the need of special efforts, the president of the Board of Agriculture expressed the conviction that "if agriculture had made no more progress in Germany than it has in the United Kingdom during the period 1895–1915, the German Empire would have been at the end

of its food resources long before the second year of the war;" and he explained further that the war was being fought by that country quite as much on an agricultural as on a military organization of the nation.

In an appeal to farmers for an increase in the food production of England Lord Selborne said: "You have something more on your shoulders than your own business to-day. You are no longer individual farmers making your own fortunes or losing them. You are trustees on your own land to do your best for England. You have your duty quite as clear and as definite as the captain of a cruiser or the colonel of a battalion. England has a claim on you farmers, men and women of every class, as clear as she has on our sons and husbands to go and serve in the trenches."

The force of the situation in Great Britain is illustrated by the fact that of the total area of cultivated land, two-thirds is in permanent grass and only one-third in cultivated crops, whereas in Germany the proportion is exactly reversed; and, furthermore, by the fact that even in 1915, when the wheat crop was the largest for many years, three-fourths of the wheat supply of Great Britain had to be imported. In 1915 the United Kingdom imported agricultural products valued at £276,803,000, whereas in the year before the war France spent only £60,000,000 for imported food products.

Similarly, in Germany the need for the greatest possible production of food has been impressed upon the people. The thorough cultivation has been urged of every available piece of land on farms and in towns, and societies have been formed to take the work in hand. Efforts have been made, for example, by the Moor Culture Union to increase vegetable growing on moor land, the society announcing allowances to disabled soldiers settling on such lands.

The measures adopted by the various nations are of much interest. The French Government early applied organization to the resumption of farming in affected areas and its continuance on an efficient basis elsewhere. To save the crops the small holdings were "pooled," the inhabitants of the villages who remained being grouped together for that purpose and the assistance of the military given when circumstances allowed. The government also took measures to prevent the wholesale slaughter of live stock, first suppressing the customs duty on practically all food stuffs including frozen meat, and then excluding from requisition for army purposes cows in milk or in calf, brood mares, premium sires, pedigreed stock, heifers, and plow oxen. Similar measures were taken in Great Britain and Germany. In the districts of France that had been invaded, the peasants were in need of horses, implements, seeds, fertilizers, forage, etc. To provide these the government made advances to the peasants, and to prevent the credit banks from breaking down from demands upon them it loaned

money to the Caisses Regionales de Credit Agricole, which in turn advanced money to the cooperative societies. Steps were taken to increase the amount of gardening carried on, by putting the opportunity for cultivating gardens within reach of even the humblest. The services of schoolmasters were enlisted to instruct children in gardening and to carry on model gardens.

To direct these efforts a "committee of agricultural action" was formed in each commune. These committees have formed a part of the government's plan for mobilizing agricultural labor, and have also become responsible for the cultivation of farms or holdings which have fallen out of use, the supply of seeds, fertilizers, etc.

In Germany systematic provision has been made for the cultivation of the land—selecting the crops most needed, for providing fertilizers and feeds, and economy in the utilization of agricultural products. In addition to its previous agencies and its food bureau, an imperial office for vegetables and fruit, to further the production, sale, and preservation of fruit and vegetables, was established the past year, with power to provide for the growth of the necessary amount of these supplies and their preservation.

In Great Britain the organization for agriculture has been greatly extended and strengthened. War agricultural committees and borough war food societies have been organized extensively for the assistance of farmers and to secure further allotments of land for cultivation. Attention has been turned to the utilization of land not ordinarily employed in agriculture, such as private parks, golf links, pleasure grounds, etc., as well as bringing more land into cultivated crops, employment of waste woodland for raising pigs, etc.

The farmers have been urged to plow up the poorer of the permanent pastures, shorten the period of grass and clover in rotations, bring the remaining grass into the highest stage of production to enable it to carry more stock, reduce the acreage of bare fallow, and to cultivate more extensively crops for food and for animals.

The labor problem has been a difficult one in all the countries. In Great Britain persons employed in certain agricultural occupations have been exempted from military duty, but despite this, it is estimated that up to the middle of 1916, 320,000 men had been taken from the land. Special efforts have been made to secure labor at critical times, as during harvest, by a national volunteer movement, and women have been drawn into agricultural occupations as never before. In this they have shown marked adaptability and brought much favorable commendation on their services. Nearly every issue of the *Journal of the Board of Agriculture* gives accounts of the successful and satisfactory employment of volunteer women laborers, frequently drawn from classes not accustomed to outdoor work. Women's committees have been active in securing recruits, and to

overcome prejudice in some sections and convince farmers of their fitness for farm work, agricultural demonstrations have been held by women in doing various kinds of operations, such as plowing, handling teams, shearing sheep, etc.

The employment of women is even more extensive in other countries at war, and in many places the temporary employment of soldiers has been of very great assistance. The Army Council in Great Britain issued instructions the past season that as far as possible farmers be loaned draft horses, mules, and drivers for help in harvesting in the neighborhood. In Germany special attention was given this year to the prompt and proper harvesting of crops. In many cases public work of all kinds was interrupted in order to set free labor for that purpose. The extensive granting of furloughs by the military authorities contributed considerable supplies of soldier labor. In some sections the help of school children was enlisted in gathering the potato crop. France, Germany, and England to some extent, have made use of prisoners of war in carrying on farm work, the custom being to require the employer to pay a small wage for the services and provide suitable conditions for living. The results have generally surpassed expectations.

The various measures in aid of agriculture have presented fine examples of cooperation between national, state, and local agencies. There has been cooperation between the civil and military branches, supported by a realization of the necessities of each, and between governmental and private organizations, often formed voluntarily for the purpose. The strength which this union of effort has given has enabled agriculture to maintain itself under most trying conditions.

But the measures for maintaining the food supply and other necessities have not stopped with the physical means of production. They have extended to advice and direction on the side of better farming, the conservation of supplies, and the utilization of new sources. The effort has tested ingenuity and resourcefulness to an unusual degree, and in this direction has led to new demands upon the various classes of agricultural institutions. It is interesting to note especially the effect upon the activities of the experiment stations and other agencies of research.

As was natural, there has been a decrease in the kind of activity which has characterized the European stations in normal times. The product of their past work has, however, become a source of great strength and resourcefulness in the countries at war. It has been drawn upon to a hitherto unprecedented degree, even that of more theoretical character. The years of experiment and investigation and application have been realized upon in a way which has furnished renewed conviction of the practical value of such effort. Coupled

with systematic agricultural education and the various forms of instruction and advice given upon farming, it has enabled effective resistance and decreased suffering.

The forces of many of the experiment stations have been considerably depleted by the war, through drafts for field service and death, and through the diversion of their activities in other directions. A station in Austria reports that it has been turned into a hospital; others have been largely diverted to making the necessities of life, serum, war munitions, etc.; a prominent investigator in Russia writes that he is now occupied in making preserved foods for the army on a commercial scale. In general the investigation is taking more practical forms, even among men whose previous work has been especially along theoretical lines.

The director of the Rothamsted Station, writing at the close of last year, said: "The war is of course affecting us, though less than we thought it would. My young men have now practically all gone or are on the point of going, but their places are being filled by women so that the work continues. Naturally, of course, the objective has altered and the more academic problems are put on one side in order that more urgent matters can be dealt with. Much of our work now is advisory and some very interesting problems are turning up."

This advisory work and the making of tests and trials of various kinds are being participated in generally by the agricultural institutions in England and other countries. Nearly every number of the *Journal of the Board of Agriculture* contains notes on feeding stuffs, with suggested rations, prices per food unit, and similar information, supplied by the Animal Nutrition Institute of Cambridge University; advice as to sources and values of commercial fertilizers occupies a prominent place, and there are reports of numerous simple practical trials of fertilizers and feeds for immediate application. In some countries rules for the practical farmer are being worked out, and elsewhere tests made of new materials to serve as substitutes in agriculture or to replace the necessities of life in time of scarcity and high prices.

The maintenance of the industry on an efficient basis, with many of the ordinary supplies of fertilizers, feed, spraying materials, etc., diminished or cut off, has taxed the fund of knowledge and the resources of agricultural science. The high price and scarcity of copper has led to experiments to secure substitutes for copper salts in fungicides. The hot water method is being reverted to in treating seed for smut, and lime-sulphur is being given wider use. In France, unusually heavy losses were sustained from black rot in the vineyards, because of the inability to spray as much as usual.

Everywhere special stress is laid on the control of diseases and other injuries of standard crops like cereals, potatoes, beets, and

grapes, to protect the food supply. We read, also, of efforts to prevent losses other than those due to insects and plant diseases, such as the killing off of wild animals, birds, etc., which injure or feed upon farm and garden crops, and of restrictions placed on the feeding of wild game. Unusual stress is laid upon procuring good seed which will yield large returns, and special efforts have been made to provide such supplies. Plant diseases have been studied mainly from the practical side, with special reference to their control. The entomological studies have dealt largely with the relation of insects to the spread of disease.

Naturally there has been a great deal of work along food lines, with tests of various kinds of material for human food and for feeding stuffs. Yeast preparations, for example, have been devised as substitutes for meat, and found very digestible, and an egg substitute has been made from blood serum. Food preservation has taken great strides, especially desiccation by freezing or drying.

A process has been devised for preparing a cattle food from potatoes which can be kept for a long time with small loss, by fermenting small and refuse potatoes in vats by means of special cultures. To meet the need for stock feed in Germany, methods have been perfected for utilizing straw, peat, and other coarse materials by chemical means and by fermentation, reinforcing the product with dried yeast or with potato flakes and molasses. Many substitutes for oats have been devised and experimented with, among others one called chicory crumbs, made from dried chicory roots.

In veterinary lines there has been much investigation upon antiseptics to take the place of more expensive ones, sugar and salt being found effective in many cases in the treatment of animal wounds. The use of polyvalent serum, formerly used in the treatment of human wounds, has been applied to animals. Some of the institutions formerly prominent in research work have been quite extensively occupied in serum making. Considerable work in the veterinary line is reported as coming from the field service instead of the laboratory.

In Germany there has been much activity in the fixation of atmospheric nitrogen, for general uses and for fertilizers, some marked advances having been made in the direction of efficiency and economy. Small beets, cull apples, beet residues, etc., are being employed in alcohol making; and many studies are reported on vegetable sources of oil.

The testing of farm machinery has been given special impetus on account of shortage of labor, and in some sections cooperative farm implement societies were formed to provide funds for their purchase

or joint ownership. Of late, however, some difficulties have been experienced in securing the allotment of petrol for their operation. It was announced during the past summer that the Italian Government contemplated extensive purchases of labor-saving agricultural machines, to meet the difficulties caused by lack of farm hands—a new experience in that country.

Naturally the effect on the character of the agricultural literature from abroad has been quite marked. The standard journals come less frequently and several have been suspended. Many of the research articles now published relate to work done prior to the war, rather than current investigation; and summaries of old work are common, to point out the practical application of the results. The more strictly scientific publications, especially the publications of scientific academies and the general review journals, show a much reduced size as compared with the volumes of 1913 and 1914. This is, of course, to be expected, and the wonder is, not that so relatively little but that so much new investigation is being recorded at this time.

As noted above, there is unusual activity in the direction of popular articles based on good scientific practice, results of tests of substitutes for the customary articles of food, feeding stuffs, fungicides, fertilizers, textiles, etc., immunization against disease, and advocacy of the raising of small animals for food, such as poultry, rabbits, goats, etc., the latter occupying much space. There are reports of field crops tried out to supply local deficiencies, such as oilseeds and fiber plants in Germany; new varieties developed with a view to increased production on limited areas, tests of crops in regions in which they have not previously been grown to advantage, such as sugar beets in southern France, the feeding value of various unusual or waste products, and the like.

Several standard periodicals have suspended publication, among them apparently the *Annales de l'Institut Agronomique de France* and *Annales de l'Ecole Naturale Agronomique de Montpellier;* and nearly all the Belgian literature has ceased entirely. A notable exception is the *Bulletin Agricole du Congo Belge*, published by the Belgian Ministry of Colonies, which is now being issued in London, and two numbers of a new series *Etudes de Biologie Agricole*, which have been published by this ministry.

The agricultural literature from France has considerably diminished. Practically no scientific literature has been received from Germany since June, 1916, presumably on account of difficulties of transportation. The Italian literature shows less variation from the previous subject matter than does the French, German, and English.

The official organ of the stations in that country, and also that of the Hungarian stations, has shown but little change.

Very many of the agricultural colleges and schools have felt the effects of the war. For example, in England the Royal Agricultural College at Cirencester, and the Agricultural and Horticultural College at Uckfield have been closed, and Armstrong College has been taken over as a military hospital, its agricultural department being temporarily housed in a dwelling.

Many of the French schools of agriculture had to close their doors on the outbreak of the war, but arrangements have since been made to open most of them. The national schools of agriculture at Rennes and Montpellier are being occupied by the sanitary service. A considerable number of the practical schools of agriculture and the farm schools have resumed operation, and several of these are receiving soldiers injured in the war.

In Austria twelve farm schools, thirty-five winter schools, and seven elementary forestry schools were temporarily closed on account of the war. Several minor institutions in Germany closed their doors temporarily, and the courses and attendance at the larger universities were much affected.

It is interesting to note that for the past two years the program of the British Association meetings has shown indications of the war's influence. The address of the president of the Agricultural Section last year dealt with the subject of farming and food supplies in time of war, showing the share contributed by British agriculture to the national food supply, and the extent to which it had assisted in making good the lack of supplies cut off by the war. This year the presidential address before that section was by Dr. E. J. Russell, director of the Rothamsted Station, and was on the subject of The Possibilities and Prospects of Increased Food Production.

The bulk of Dr. Russell's address was devoted to a consideration of the means of increasing the yield per acre, and of reducing the cost per acre and the uncertainties of production. He pointed to certain modifications and adaptations in the interest of larger production, notably a closer coordination of crop variety, soil and climatic conditions, increased efficiency in fertilizer treatment, and improvement in the management of barnyard manure to avoid waste. He also referred to the need of agricultural education to raise the ordinary farmer to the level of the good one, to the extension of the area of land under cultivation by the reclamation of waste, and to the substitution of arable crops for grass. The manner of treatment of the subject showed a broad grasp both of the opportunities and the means of extending production; and was typical of the liberal, scholarly study which is being given the subject at this time.

The war has gone a long way to impress upon governments and the public generally the vital position which production occupies and the advantages of the new agriculture. The supreme importance of scientific research in all branches has been impressed upon the countries of Europe by the most remarkable demonstrations ever furnished. In these demonstrations and convictions the indispensableness of science to an adequate agriculture has been given a new understanding; and in the general results the institutions and working forces charged with the prosecution of science and education in agriculture have richly shared.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Chlorophyll, G. Cusmano (*Ann. Chim. Appl.* [*Rome*], *5* (*1916*), *No. 3–4, pp. 97–117, pl. 1, fig. 1*).—This is a general review of the work on chlorophyll. The subject is discussed under the following divisions: The action of alkali and acid on chlorophyll; the isolation of chlorophyll and separation into its two constituents; the carotinoids; comparison of the pigments of the leaves; and the structure of chlorophyll. A table showing the amounts of the various green and yellow coloring substances of the leaves and also one showing the decomposition products and derivatives of chlorophyll are submitted.

Bean oil (oil of Phaseolus vulgaris), F. Witke (*Chem. Ztg.*, *40* (*1916*), *No. 19–20, pp. 147, 148*).—The following constants for an oil extracted by benzene from the air-dried material are submitted: Yield, 2 per cent; acid value, 17.2; saponification value, 179.2; ester value, 162; iodin value, 97.9; Hehner value, 78.2; unsaponifiable matter, 5.6 per cent; phosphorus, 0.98 per cent; lecithin, 25.6 per cent; and refractive index at 25° C., 1.4865. The fatty acids were isolated in the usual manner and yielded the following constants: Saponification value, 193.1; iodin value, 124.6; acetyl value, 52.7; acetyl acid value, 175.4; acetyl saponification value, 228.1; and refractive index at 38°, 1.4691.

The disagreement in the results obtained compared with those previously reported is briefly discussed.

The fatty oil from the seed of Styrax japonica, H. Okada (*Yakugakuzasshi* (*Jour. Pharm. Soc. Japan*), *No. 400* (*1915*), *pp. 657–665*).—The author obtained a yield of 45 per cent of a greenish-yellow oil with a red fluorescence from the cold-pressed seed.

The following constants were obtained for the oil: Acid value, 1.1; saponification value, 190.5; Hehner value, 94.7 per cent. The solid acids consisted of an equal mixture of stearic and palmitic acids, while the liquid acids consisted of oleic and linoleic acids. The unsaponifiable substance crystallized in glistening needles, with a melting point of 116° C.

The galactan of Larix occidentalis, A. W. Schorger and D. F. Smith (*Jour. Indus. and Engin. Chem.*, *8* (*1916*), *No. 6, pp. 494–499*).—The authors have found that the wood of the western larch (*L. occidentalis*) contains approximately 10 per cent of a galactan not previously described. The galactan has been named ϵ-galactan. On hydrolysis it yields only galactose. The determination of galactans by oxidation to mucic acid with nitric acid according to the method of Tollens is deemed unreliable. Galactans have been shown to be characteristic of several of the common conifers.

The synthesis of acetaldehyde in fruits, H. Müller-Thurgau and A. Osterwalder (*Landw. Jahrb. Schweiz*, *29* (*1915*), *No. 5, pp. 508, 509*).—In a study on the influence of sulphur dioxid on yeasts and bacteria in wine and fruit juices it was observed that the sulphurous acid was in some way so chemically bound as to become inactive. Further investigation showed that the sulphur dioxid was bound by the aldehydes present in the juice. Aldehyde

was found, however, only in fully ripe fruits. In pears the amount was found to increase gradually until a maximum was reached in the overripe stage of the fruit. The presence of aldehyde was only occasionally demonstrated in apples, and in one sample of grapes examined was absent.

The urease content of certain beans, with special reference to the jack bean, J. G. Mateer and E. K. Marshall, Jr. (*Jour. Biol. Chem., 25 (1916), No. 2, pp. 297–305*).—The authors have demonstrated that the jack bean (*Canavalia ensiformis*) contains about 15 times as much urease as the soy bean. The extract from the jack bean, however, contains much less solid residue than the soy-bean extract. The urease appears to be specific for urea, just as is the enzym obtained from the soy bean. The use of the jack-bean urease for the rapid removal of urea from solutions in which as little contaminating material as possible should be added, and its use for quantative urea determinations is indicated. The presence of urease was also established in the urd bean (*Phaseolus aureus*) and the horse gram (*Dolichus biflorus*).

Notes on collodion membranes for ultrafiltration and pressure dialysis, G. S. Walpole (*Biochem. Jour., 9 (1915), No. 2, pp. 284–297, figs. 5*).—This article describes the preparation of collodion test-tube shaped bags and their use for simple ultrafiltration and dialysis experiments. On account of their lack of uniformity and the difficulty of accurate reproduction their use is not recommended for careful work.

Flat membranes are prepared by pouring alcohol-ether solutions of collodion on leveled plate glass and then plunging the film, after partial evaporation of the alcohol and ether, into water. With proper precautions films of remarkable uniformity can be prepared. It is suggested that "in these films, more than in other ultrafilters in general use, the channels leading through the gel structure from one side to the other are of a certain uniformity in size. None of them is large enough to allow any antigen to pass; but the structure is highly porous and, because there are many such channels, rapid ultrafiltration results."

The arrangements of apparatus in which the flat membranes and also the test-tube shaped membranes can be utilized for ultrafiltration and pressure dialysis are described in detail.

A rapid filter for turbid liquids, R. C. Shuey (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, p. 523, fig. 1*).—An ordinary suction filter, using the paper pulp used by distillers, and its manipulation are described.

A rapid method for comparing the decolorizing efficiency of charcoals, L. Wickenden and J. W. Hassler (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 518, 519, fig. 1*).—A method which is rapid and enables charcoals to be classified with great ease and accuracy according to their decolorizing efficiency is described. A solution of Soudan III or Oil Red RN in kerosene is used for the test. The solutions filter rapidly and come through clear and bright. The preparation of a standard scale for classifying the charcoals and also a simple colorimeter which facilitates the procedure are described.

A new colorimeter, C. F. Sammet (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 519–521, fig. 1*).—The author describes a colorimeter which is easily adjusted. Although designed for reading the color of turpentine, it is equally well adapted for other colorimetric work when standard glasses can be employed and the solution does not attack the metallic cell.

A Kjeldahl fume remover, F. G. Merkle (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 521, 522, figs. 3*).—An apparatus consisting of a lead pipe of 0.5 in. inside diameter, to which are soldered as many 3-in. lead tubes ($\frac{1}{8}$ in. diameter) as desired, is described. The small tubes are fitted with rubber stoppers, which are in turn fitted to the flasks used in the digestion. The acid

fumes are disposed of by passing into a sink pipe which is washed with a stream of water or in some other convenient manner.

A small apparatus for two flasks is also described.

Contribution to the determination of citric-acid-soluble phosphoric acid by the iron-citrate method, N. Zachariades and J. Czak (*Ztschr. Landw. Versuchsw. Österr., 18 (1915), No. 7, pp. 472–475*).—Experimental data of the analysis of a number of slags by the iron-citrate method are submitted. From these data the authors conclude that the addition of hydrogen peroxid for the purpose of oxidizing any hydrogen-sulphid combinations is usually superfluous, especially if the odor of hydrogen sulphid is only weakly perceptible. The precipitate need not be filtered immediately, as has been previously recommended. The data submitted check very well with results obtained by the procedure of Popp.

Note on the determination of phosphorus in plant materials, A. W. Christie (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, p. 511*).—Experimental data submitted from the California Experiment Station indicate that the ignition of the sample with magnesium oxid is a quick and accurate method of oxidizing the organic material in the determination of total phosphorus. Oxidation with fuming nitric acid was found to be unsatisfactory.

Studies on the determination of sulphur as barium sulphate, P. L. Blumenthal and S. C. Guernsey (*Iowa Sta. Research Bul. 26 (1915), pp. 390–436*).—The purpose of the investigation reported was chiefly "to discover the magnitude and causes of the error involved in the usual method of determining total sulphur, particularly in lime-sulphur solutions; . . . to ascertain the method best adapted to estimating total sulphur . . . and to extend our knowledge of the mechanism of the reaction." The history and use of the method are reviewed and discussed in some detail.

Experimental results with potassium and sodium sulphates, showing the effect of various rates of addition of barium chlorid in definite quantity and of varying strengths at constant volume and acidity, demonstrate that there is little choice between the use of 5 and 10 per cent barium chlorid, the time of addition being slightly more important. Five per cent barium chlorid added at the rate of 5 cc. per minute was found to yield the best average results in the work at hand. Various strengths of acid were found not to influence the results to any great extent, although a low acidity was preferable (2 per cent or less).

In studying the effect of various salts on the precipitation it was found that when sodium salts were the only impurity very concordant analyses could be obtained. In the presence of calcium the results obtained did "not differ markedly from the figures obtained in the presence of other salts. The same variations occur, and again the necessity of working under exactly uniform conditions is emphasized." The presence of magnesium in general yielded high values. From a general consideration of the analytical results the authors arrive at the conclusion that "a pure precipitate of barium sulphate is not to be obtained by any ordinary precipitation method. The best values are due to a balancing of errors, and to insure uniformity of analyses the strictest attention must be given to maintaining definite and identical conditions in the system."

For accurate lime-sulphur analyses the following procedure is recommended: One aliquot is oxidized with sodium peroxid, heated, diluted, acidified, boiled, precipitated rapidly with 5 per cent barium chlorid, and filtered through a Gooch crucible after an hour's standing. A general idea of the amount of sulphur in the definite volume of solution is thus obtained. The volume of the final determination is so adjusted that each cubic centimeter will contain

about 1 mg. of barium sulphate. The final volume of the solution after precipitating the sulphate should thus be about 250 to 350 cc. After oxidizing a suitable aliquot with sodium peroxid, heating to hasten the oxidation, and acidifying, the solution should be boiled to drive out dissolved gases, exactly neutralized, and an amount of concentrated hydrochloric acid added so that the volume percentage of hydrochloric acid does not exceed 2 per cent. After diluting the acidified solution to the proper volume it is heated to boiling and precipitated hot with 20 cc. of 5 per cent barium chlorid added from a burette at the rate of from 5 to 10 cc. per minute, preferably at the slower rate. The solution should not be shaken or stirred. The beaker and contents after the precipitant has been added are set aside and allowed to stand for at least 12 hours before filtering. After filtration the precipitate is washed with cold water until free from chlorids, using a uniform quantity of wash water, 150 cc. added in 15 cc. portions usually sufficing to free a precipitate of this size from chlorids, and introducing a negligible loss due to solubility of barium sulphate.

In an attempt to increase the knowledge of the mechanism of the reaction other precipitants for sulphur were tried. The authors conclude that they have no better explanation for the mechanism of the reaction than those offered by earlier investigators. The necessity for following a definite set of conditions in sulphur analysis is strongly emphasized.

A list of 43 references cited is appended.

The quantitative determination of the total protein and nonprotein substances of muscle. Improved technique, N. W. Janney (*Jour. Biol. Chem.*, *25* (*1916*), *No. 2*, *pp. 177–183*).—The following modified quantitative procedure is outlined:

"The fresh muscle is freed from all adherent fat and connective tissue, passed through a meat grinder, and thoroughly mixed. About 10 gm. is weighed by difference into a beaker from a weighing glass provided with a ground glass lid. Fifty cc. of 95 per cent alcohol is added and the contents of the beaker heated, with stirring, until the alcohol boils. The liquid is then decanted through an ordinary round filter of 12.5 cm. diameter, which has previously been extracted with alcohol and ether, dried, and weighed. This treatment of the protein with alcohol is once repeated.

"The coagulated muscle is next extracted in a similar manner with 400 cc. of boiling water in four portions, and then brought quantitatively on the filter. The filter is now carefully folded about the protein material, which is gently inserted into an extraction hull and extracted three hours in an ordinary Soxhlet apparatus with 95 per cent alcohol. The 95 per cent alcohol is then replaced by absolute alcohol and the extraction continued for a period of 15 hours. Care must be taken that the filter projects beyond the upper level attainable by the solvent, which must completely surround the protein. After completion of the extraction the filter with the pure protein is removed from the apparatus, dried to constant weight at 105° [C.] in a weighing glass provided with a ground glass lid, and the previously ascertained weight of the filter paper deducted."

When required, the nonprotein substances are determined by deducting the percentage of protein found from the percentage of total solids.

The protein content of muscle, N. W. Janney (*Jour. Biol. Chem.*, *25* (*1916*), *No. 2*, *pp. 185–188*).—This material has been essentially noted from another source (E. S. R., 35, p. 315).

The ninhydrin reaction with amino acids and ammonium salts, V. J. Harding and F. H. S. Warneford (*Jour. Biol. Chem.*, *25* (*1916*), *No. 2*, *pp. 319–*

335).—The experimental data demonstrate that ammonium salts of weak acids react positively with ninhydrin in concentrations of 1 per cent. In very high concentrations the ammonium salts of strong mineral acids give a positive ninhydrin reaction. Reducing agents increase the sensitiveness of the ninhydrin reaction with ammonium salts.

"In the presence of pyridin and in a concentration of 1 cc. = 0.05 mg. of nitrogen, all ammonium salts react positively with triketohydrindene hydrate. The amount of decomposition of the ammonium nitrogen was found to be independent of the acid radical attached and possessed a constant value of 0.018 mg. nitrogen; the blue coloration is due to the ammonium salt of diketohydrindylidene-diketohydrindamin."

A theory as to the mechanism of the reaction with amino acids and ammonium salts is suggested.

The ninhydrin reaction with amins and amids, V. J. HARDING and R. M. MACLEAN (*Jour. Biol. Chem., 25* (*1916*), *No. 2, pp. 337–350*).—"The ninhydrin reaction is given by organic bases of the type RCH_2NH_2, and R_2CHNH_2 where one radical is negative in character. Other bases which readily yield ammonia or are readily oxidized give the ninhydrin reaction. With the fatty amins and in the presence of pyridin the strongest reaction is given by the simplest members. Amids give no reaction with ninhydrin. Guanidin and its derivatives give a negative test."

The nonspecificity of the ninhydrin reaction for amino acids, especially in very small amounts and in the presence of large amounts of ammonium salts, is emphasized.

On the determination of phytosterol in animal fats according to Bömer's acetate procedure with the separation of the stearins by precipitation with digitonin, B. KÜHN, F. BENGEN, and J. WEWERINKE (*Ztschr. Untersuch. Nahr. u. Genussmtl., 29* (*1915*), *No. 8, pp. 321–329*).—The authors outline a modified procedure as follows:

Fifty gm. of fat is heated with 100 cc. of alcoholic potassium hydroxid (200 gm. KOH dissolved in 70 per cent alcohol and made up to 1 liter) for 15 minutes on a water bath. The clear soap solution is diluted with 150 cc. hot water and then 50 cc. hydrochloric acid (specific gravity 1.124) is added. The clear fatty acids are then separated from the KCl-glycerin mixture by filtration. To the warm liquid acids 25 cc. of a 1 per cent solution of digitonin in 96 per cent alcohol is added, and the mixture is thoroughly stirred and allowed to set on the water bath at a temperature of 70° C. for from 0.5 to 1 hour, according to the amount of stearins present. To the mixture, from 15 to 30 cc. of chloroform is now added and the precipitate carefully filtered on a Witte plate with gentle suction. The precipitate is washed from three to five times with chloroform and in the same manner with ether. When free from fatty acids it is dried for ten minutes at from 90 to 100°. The precipitate is now strongly boiled with from 3 to 5 cc. of acetic anhydrid for about five minutes, in which time the reaction is usually complete. Four volumes of 50 per cent alcohol are now added and the mixture cooled. After from five to ten minutes the precipitated acetate is filtered through a small filter, washed with 50 per cent alcohol, and then recrystallized from ether solution.

Analytical data of the melting points of stearin acetates obtained from 75 different samples of fats and mixtures are submitted.

The determination of stearins by means of digitonin, O. PFEFFER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 31* (*1916*), *No. 2, pp. 38–40*).—The procedure modified by Kühn et al. (see previous abstract) was found to yield excellent results.

The physiology of souring of pure and watered milk, F. Reiss (*Ztschr. Untersuch. Nahr. u. Genussmtl., 31 (1916), No. 2, pp. 41–45*).—From experimental data submitted it is concluded that within rather wide limits of milk watering in the course of lactic acid fermentation amounts of lactose are fermented which are inversely proportional to the degree of watering. While more conclusive evidence is necessary to answer the question whether the degree of acidity can be definitely used as an index of the amount of water, it is deemed certain that from the degree of acidity of sour milk it can safely be determined whether or not the milk was originally watered.

The gravimetric determination of reducing sugars in cane products, G. P. Meade and J. B. Harris (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 504–509*).—In clarifying the sugar solutions the authors found that different results were obtained by the use of varying amounts of neutral lead acetate solution.

"Carbonate, sulphates, and oxalates are not interchangeable as deleading agents, oxalates giving results from 4 to 5 per cent higher on the weight of copper than where either of the others is used. Kieselguhr only, without the use of lead or other reagent, gives a clear filtrate, both with final molasses and raw sugar, and the solution offers no mechanical difficulty in the precipitation and collection of the copper precipitate. Without lead the results are slightly lower than where lead and oxalate are used."

Results obtained by weighing the cuprous oxid were about 5 per cent higher on the weight of copper than those obtained by igniting and weighing as cupric oxid. Volumetric iodid determinations of the copper checked the cupric oxid results.

It is indicated that, "under strict specifications as to the quantity and class of reagents, any method for the preparation of the solution for analysis will give results which check within themselves."

The determination of the gelatinizing temperature of the starches from the grain sorghums by means of a thermo-slide, C. K. Francis and O. C. Smith (*Jour. Indus. and Engin. Chem., 8 (1916), No. 6, pp. 509–511, figs. 2*).—This material has been previously noted from another source (E. S. R., 35, p. 108).

A colorimetric method for the estimation of free formaldehyde and hexamethylenamin, R. J. Collins and P. J. Hanzlik (*Jour. Biol. Chem., 25 (1916), No. 2, pp. 231–237*).—A colorimetric method in which the phloroglucinol reagent (0.1 gm. phloroglucinol in 10 cc. 10 per cent sodium hydroxid) is used is described.

Permanent color standards are prepared from mixtures of Congo red and methyl orange. Standard mixtures for concentrations of formaldehyde between 1:1,000,000 and 1:20,000 have been determined and are submitted. It is indicated that the procedure described is more accurate than the Romijn, the United States Pharmacopœia method, and the hydroxid pressure method. It is directly applicable for the determination of free formaldehyde in urine.

[Report of the fermentation and bacteriological section], H. Müller-Thurgau and A. Osterwalder (*Landw. Jahrb. Schweiz, 29 (1915), No. 5, pp. 537–568*).—Experiments on the value of washing the fruit preliminary to pressing demonstrated that the washing did not yield a purer fermentation or a more stable product. In the reduction of the acidity of wines, partial neutralization with calcium carbonate and further reduction to any degree of acidity desired by the action of *Bacillus gracilis* at various temperatures was found to yield satisfactory results.

From results obtained in connection with studies on the influence of sulphurous acid on fermentation processes in wines and fruit juices, it is indi-

cated that the amount of sulphur dioxid which actually inhibits alcoholic and the various acid fermentations so varies that no exact amount to be used can be prescribed. An investigation on the effect of sulphur dioxid on wine diseases indicated that the use of sulphur dioxid is a valuable aid in preventing the lactic-acid disease which is so prevalent in certain fruit juices, especially those obtained from overripe pears and apples. On account of the presence of aldehydes in the juices the sulphurous acid soon becomes inactive, so that for reliable results sufficient quantities of potassium metabisulphite should also be added, but because of the continued production of aldehyde during fermentation the quantity of sulphur dioxid and potassium metabisulphite necessary should be largely regulated by the activity of the fermentation. An undue excess is to be avoided at the beginning of the fermentation, as it may injure the bacteria (*B. mannitopoeum* and *B. gracilis*), although not the yeasts.

[Report of the chemical section], W. J. BARAGIOLA, C. GODET, and O. SCHUPPLI (*Landw. Jahrb. Schweiz, 29 (1915), No. 5, pp. 568–572*).—These pages briefly report the results obtained in the investigations on the difference between acid content and degree of acidity; analytical investigations on the ripening of grapes and the wine obtained therefrom; acid reduction in wine in relation to its analysis, physicochemical properties, and hygienic value; the fermentation of grape must under paraffin oil; and the various combinations of sulphur in wine and their determination.

METEOROLOGY.

Weather as a business risk in farming, W. G. REED and H. R. TOLLEY (*Geogr. Rev., 2 (1916), No. 1, pp. 48–53, figs. 4; abs. in U. S. Mo. Weather Rev., 44 (1916), No. 6, pp. 354, 355, figs. 3*).—It is pointed out in this article that the occasional occurrence of unfavorable weather conditions is a risk which must be recognized by successful farmers, and it is stated that in the case of phenomena whose distribution follows the "normal law of frequency" this risk may be determined with a fair degree of accuracy. A method of determining the risk of frost occurrence is described in this paper, and the opinion is expressed that a method of computing the risk from other more complicated phenomena can be worked out.

"To compute the time available for plant growth in a given proportion of the years the most satisfactory method is that based on the risk at each end of the growing season. If the chance of safety on a given date in spring is one-half and that on a given date in fall is one-half, the chance of safety for the whole period between is one-half multiplied by one-half; that is, one-fourth. For many important crops about a four-fifths chance of safety is essential for continued success. . . . For any place the length of the available growing season (that is, number of days for which the chance is four in five), beginning at the date when the frost risk falls to 10 per cent, is the number of days between this date and the date on which the chance of fall frost rises to 10 per cent."

A table is given which simplifies the computation. It is stated that "although this method of determining business risk is subject to limitations because of the shortness of the individual records, a careful examination of the records shows that in the large the computed dates on which the frost risk rises (or falls) to 10 per cent, when compared with the actual number of occurrences, is a very close agreement. From a total of 27,157 observations the lack of agreement between the computed and counted cases was but 17 in 10,000."

Critical period of growth (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 22 (1916), pp. 2, 3, fig. 1*).—Attention is called especially to the use of rainfall charts in relation to the critical periods of corn, the most important of which is the ten days following the date of blossoming.

Weather and the yield of corn (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 14 (1916), p. 2, fig. 1*).—The relation between the yield of corn and the rainfall in Ohio, Indiana, Illinois, Iowa, Nebraska, Kansas, Missouri, and Kentucky for the 28 years from 1888 to 1915, inclusive, is shown in a diagram and briefly discussed. The most striking fact brought out is that whenever the rain for July has been above the normal the yield was above the normal in every instance. Whenever the rainfall was below the normal the yield has also been below in every year except five.

The four greatest corn States (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 15 (1916), p. 2, fig. 1*).—It is shown that the average yield of corn for Indiana, Illinois, Iowa, and Missouri is 32 bu. per acre, and that the average July rainfall for the region covered by these States is 3.9 in. The preeminence of these States in corn production is shown to be closely correlated with the July rainfall.

Rainfall and temperature and corn yield (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 18 (1916), pp. 2, 3, fig. 1*).—The effect of July rainfall and temperature on the yield of corn in Ohio during the period from 1854 to 1915, inclusive, is shown in a diagram and briefly discussed. The July rainfall is shown to be the dominating factor.

Weather and yield of potatoes (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 19 (1916), pp. 2, 3, fig. 1*).—A study of the effect of temperature and rainfall upon the yield of potatoes in Ohio, Michigan, and New Jersey is reported, showing that the temperature of July is the most important weather factor in those States. A cool July is most favorable.

Monthly Weather Review (*U. S. Mo. Weather Rev., 44 (1916), Nos. 5, pp. 243–319, pls. 9, figs. 18; 6, pp. 321–379, pls. 14, figs. 28*).—In addition to weather forecasts, river and flood observations, and seismological reports for May and June, 1916; lists of additions to the Weather Bureau Library and of recent papers on meteorology and seismology; notes on the weather of the months; solar and sky radiation measurements at Washington, D. C., during May and June, 1916; condensed climatological summaries; and the usual climatological tables and charts, these numbers contain the following articles:

No. 5.—Circumhorizontal Arc Observed, by J. T. Gray; The Blue of the Sky and Avogadro's Constant, by D. Pacini; Photography of the Zodiacal Light and Counterglow, by A. E. Douglass; Propagation of Sound in the Atmosphere, by E. van Everdingen; Spontaneous Ionization of the Aqueous Vapor of the Atmosphere, II, by G. Oddo; Variation of the Emanation Content of Springs, by R. R. Ramsey; Planetary Phenomena and Solar Activity, by T. Köhl; Free-air Data by Means of Sounding Balloons, Fort Omaha, Nebr., July, 1914 (illus.), by W. R. Blair; Meteorological Symbols (illus.), by C. F. Talman; The Coefficient of Correlation as a Measure of Relationship, by C. N. Moore; Rainfall in China, 1900–1911 (illus.), by Co-Ching Chu; American Definition of "Sleet," by C. Abbe, jr.; Two Abnormal Pressure Distributions in Italy (illus.), by F. Eredia; Fog as a Source of Water Supply, by W. G. Reed (see p. 619); A Simple Wind-Velocity Indicator for Use with the Robinson Anemometer (illus.), by B. C. Kadel; Diurnal Variation of Underground Temperature, by S. Sato; Aleksandr Ivanovich Voeĭkov, 1842–1916; The Chinese Weather Bureau, by Co-Ching Chu; Flood in the Lower Mississippi, Spring, 1916, by W. E. Barron; and Rainfall and Floods in China, by S. T. Suen.

No. 6.—Meteor of June 28, 1916, Over Northeastern Texas (illus.), by H. H. Martin; Observations of Meteor Trains; Meteor of May 7, 1916, in Eastern Mississippi, by J. H. Jaqua; Meteor of May 7, 1916, at Demopolis, Ala., by J. G. Whitfield; Work of the American Meteor Society, 1914 and 1915, by C. P. Olivier; Canadian Aerological Research; Use of a Flagpole in Calibrating Kite

Anemometers (illus.), by B. J. Sherry; Solar Variability, by C. G. Abbot et. al.; Tropical Rains: Their Duration, Frequency, and Intensity (illus.), by O. L. Fassig (see below); Mechanism of Cyclones, by F. J. W. Whipple; Causes Contributory to the Annual Variation of Latitude, by H. Jeffreys; Meteorological Aspects of Oceanography (illus.), by H. Pettersson; Precipitation Over the Southeast Rocky Mountain Slope (illus.), by C. Hallenbeck; Fog in Relation to Wind Direction on Mount Tamalpais, Cal., by H. H. Wright; On the So-called Change in European Climate During Historic Times, by H. H. Hildebrandsson (see below); Violent Easterly Winds at Tatoosh Islands, Wash. (illus.), by R. C. Mize; Weather as a Business Risk in Farming (illus.), by W. G. Reed and H. R. Tolley (see p. 616); and Snow Surveys in Big Cottonwood Canyon, Utah, 1912–1916 (illus.), by H. K. Burton.

On the so-called change in European climate during historic times, H. H. Hildebrandsson (*Nova Acta Reg. Soc. Sci. Upsal., 4. ser., 4 (1915), No. 5, pp. 31, pls. 3; U. S. Mo. Weather Rev. 44 (1916), No. 6, pp. 344–352*).—From an exhaustive review of data from various sources on the subject, the general conclusion is reached "that there exist everywhere climatic variations of long and short duration, but it is not possible to prove that the climate of Europe has changed for either better or worse during historic times."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 3 (1916), Nos. 5, pp. 224, pls. 2, figs. 4; 6, pp. 224, pls. 2, figs. 4*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1916, respectively.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander and J. S. Sims (*Massachusetts Sta. Met. Buls. 331–332 (1916), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1916, are presented. The data are briefly discussed in general notes on the weather of each month.

Tropical rains: Their duration, frequency, and intensity, O. L. Fassig (*U. S. Mo. Weather Rev., 44 (1916), No. 6, pp. 329–337, figs. 15*).—The rainfall phenomena of Porto Rico and of Maryland are compared. It is shown that there is a fairly even distribution of rainy days throughout the year in both regions. Rains, especially excessive rains, are more frequent and more uniformly distributed throughout the year in the tropical region.

"Frequent moderate rains are generally more favorable for plant growth than heavier rains, assuming equal total amounts for the year. There is a wide range in the frequency of rains of 0.01 to 0.1 in. in Porto Rico, a condition which is probably common to all regions with pronounced differences in topography. As the amounts grow larger the range rapidly decreases. The best and most extensive tobacco plantations of Porto Rico are situated in the portion of the island having the greatest number of light rains, with a total annual amount close to the average for the entire island. The station at Caguas, typical of this region, shows a record of 160 days with rainfall from 0.01 to 0.1 in., with a total annual frequency of 262 days and a total rainfall of 68 in. In the mountains of the western portion of the island, a region noted for the abundance and fine quality of its coffee, the rainfall is very heavy. A peculiarity of the rains of this region is that they show a maximum frequency of amounts between 0.2 and 0.3 in., whereas the usual record shows a very decided preponderance of amounts less than 0.1 in."

Fog as a source of water supply, W. G. Reed (*U. S. Mo. Weather Rev., 44 (1916), No. 5, p. 288*).—Referring to an article by Descombes, previously noted (E. S. R., 34, p. 614), it is stated that "there is apparently a close relation

between the occurrence of summer fog and the distribution of the redwood (*Sequoia sempervirens*) in California. In addition, a result of the fog is easily seen wherever there are single trees, such as is the case on the Berkeley Hills of the coast ranges, which are in process of reforestation. During the summer fogs the small trees are dripping with moisture, although the ground away from the trees is perfectly dry. As a result the grass beneath each tree remains green throughout the year."

The climate of Roumania in relation to dry farming, L. Georgesco (*Vie Agr. et Rurale, 6 (1916), No. 11, pp. 191–194, figs. 2; abs. in Rev. Sci. [Paris], 54 (1916), II, No. 13, pp. 405, 406*).—It is explained that the climate of Roumania is typically continental and on the plains is such as to make the use of dry-farming methods desirable. The annual rainfall is seldom less than 500 or more than 800 mm., the mean being about 600 mm. (about 23.6 in.) It is smaller on the plains (300 to 500 mm.), and increases with the elevation (1,300 to 1,600 mm. in the mountains). It also varies in distribution seasonally.

Even in seasons of low rainfall the amount is sufficient for good wheat crops, provided it is suitably distributed. The average annual temperature is about 10° C. (50° F.) on the plains and from 8 to 9° at the higher elevations. There are, however, wide seasonal extremes in temperature (—35 to 40°). The daily extremes are also wide. Cold, high winds are common in winter, and dry, hot winds in summer. Bright sunshine varies from 50 to 80 per cent of the total possible. The humidity of the air varies from 50 to 60 per cent in summer and from 85 to 90 per cent in other parts of the year. The climatic conditions are such as to make early seeding in the fall and late seeding in the spring necessary.

The influence of weather conditions upon the amounts of nitrogen acids in the rainfall and atmosphere in Australia, O. Masson, V. G. Anderson, D. Avery, and H. A. Hunt (*Rpt. Brit. Assoc. Adv. Sci., 1915, pp. 87–94, figs. 3*).—This is a preliminary report upon the organization of investigations covering the whole of Australia (16 stations), similar to those reported by Anderson for the region of Melbourne (E. S. R., 33, p. 617). The plan and purpose of this work and the apparatus and methods to be used are briefly described.

Discussion on smoke abatement and air pollution (*Rpt. Brit. Assoc. Adv. Sci., 1915, pp. 387–393*).—Brief notes are given on discussions at the Manchester meeting of the British Association for the Advancement of Science, 1915, on the work of the Manchester Air Pollution Advisory Board, the work of the Sheffield Health Committee, damage to vegetation caused by atmospheric pollution by smoke, improvements in domestic fire grates, recent improvements in gas fires, and other aspects of the smoke question.

SOILS—FERTILIZERS.

Soil temperature, G. J. Bouyoucos (*Michigan Sta. Tech. Bul. 26 (1916), pp. 133*).—A continuation for three years of the field experiments previously noted (E. S. R., 29, p. 618) is reported, together with the final conclusions drawn from the entire investigation.

"The field studies on the temperature of different types of soil, namely, gravel, sand, humus loam, clay, and peat at 6-, 12-, and 18-in. depths, showed that when the surface of all these soils was covered with a thin layer of sand they had almost exactly the same average temperature throughout the year except during a short period in the spring when thawing was taking place. . . . During the summer months the peat [had] a monthly average temperature of a few tenths of a degree higher than the mineral soils. In the fall, the sand and gravel possessed a slightly higher monthly average temperature than

the peat. Whenever rapid and sudden changes of air temperature occurred the sand and gravel warmed and cooled the fastest, followed by clay, loam, and peat, respectively. The equilibrium [was] quickly reestablished. The degree of amplitude was greatest in sand and gravel, somewhat smaller in loam and clay, and least in peat. The highest fluctuation occurred in summer and the lowest in winter. The maximum temperature was approximately the same for all types of soil, after complete thawing had taken place, but the minimum varied somewhat; it was lowest in sand and gravel, slightly higher in clay and loam, and highest in peat. . . .

"When the same types of soil were not covered with a thin layer of sand but their natural surface was allowed to be exposed to the atmosphere . . . their average temperature . . . was about the same during the fall and winter months, but varied somewhat during the spring and summer months. During the latter seasons the sand and gravel [had] the highest average temperature, the clay and loam slightly lower, and peat the lowest. . . . In the spring the peat [did] not thaw and its temperature [did] not approach that of the mineral soils after complete thawing as rapidly as when its surface was covered with the thin layer of sand. Besides the average temperature the order of the maximum and minimum temperature [was reversed] in the various types of soil under the two surface conditions. . . .

"The average air temperature was lower than that of any soil at the 2-, 4-, 6-, 12-, and 18-in. depths, throughout the year. . . . The maximum temperature of all the soils at ¼-in. depth was about 30° F. higher during hot and clear days than that of the air at an elevation of 4 ft. The minimum temperature of all the soils except peat, however, immediately at the surface was only about 1 or 2° higher, as a monthly average, than that of the air at a height of 4 ft. . . . Unless the various soils were frozen they always had a gradient of temperature at their adjacent depths [which], however, reversed itself between day and night during the warm part of the year to the depth that the diurnal-nocturnal amplitude of oscillation of temperature extended. . . .

"The rate at which the maximum and minimum temperature waves traveled through any particular soil tended to follow approximately a mathematical law. . . . Thus, the lag of the maximum and minimum epochs tended to be approximately proportional to the depth in all the different types of soil.

"The decrease of the diurnal-nocturnal amplitude of temperature with the increase in depth also followed a mathematical law in all the diverse types of soil and the geometric progression law. . . . The diurnal-nocturnal amplitude of oscillation of temperature decreased in geometric progression as the depth increased in arithmetic progression, in all the different types of soil.

"The four years' data obtained on the temperature of sand to which was added different percentages of organic matter (peat) showed that during the fall and winter months all these soils had approximately the same degree of average temperature, but in the spring and summer months it varied somewhat. During the latter months the sand which received no organic matter and had a white colored surface and the peat had about the same and lower average temperature than the other soils which were treated with various percentages of peat. . . . The amplitude of temperature at the 3- and 5-in. depths was high, but approximately of equal degree in all the treated and untreated soils, but comparatively low in the peat. . . .

"The uncultivated soil had practically the same or only a few tenths of a degree higher temperature during the spring months than the cultivated and only about 1° higher during the summer months. During the fall and winter months there was hardly any difference. There did exist, however, a very marked difference in average temperature between the two bare soils and one

covered with growing vegetation. . . . Immediately upon the commencement of growth of the vegetation the temperature of the sod or grass land became decidedly lower than that of the cultivated and uncultivated soil. The maximum difference [was] reached in June and July, when the sod soil at the 7-in. depth, for instance, [was] about 6° colder than the bare soils. This difference, however, [became] smaller and smaller, so that by September it entirely disappeared, and by October the order [was] reversed; the bare plats [became] colder and the sod warmer. The latter continued to have a higher temperature throughout the fall and winter months. . . .

"In exceptionally cold weather the soil covered with vegetation and a layer of snow had 25° higher temperature than a bare soil at 3-in. depth. Certain topographic positions have a marked controlling influence upon the soil temperature. A southern exposure had about 2° higher average temperature than a northern during the spring and summer months, but during the fall and winter months both locations were equally warm. The soil temperature at a river bank was far below that of the south and north slope during the spring and summer months, but slightly higher during the fall and winter months. The marked influence of the slant of the surface with respect to the position of the sun on the soil temperature is manifested on a cultivated soil with very lumpy and uneven surface. The sides of the lumps or dead furrows facing the sun in the morning had a higher temperature than those shaded."

Fundamental interrelationships between certain soluble salts and soil colloids, L. T. Sharp (*Univ. Cal. Pubs. Agr. Sci., 1 (1916), No. 10, pp. 291–339, figs. 3*).—It was found in cylinder experiments that clay loam soil, exposed to natural conditions and to which surface applications of solutions of sodium chlorid, sulphate, and carbonate had been made, became very impervious to water, difficult to cultivate, and manifested the characteristics of a high degree of diffusion. Laboratory studies showed that the salts had moved downward into the lower layers of soil and that only the surface soil was affected.

"The deflocculated condition resulting from adding certain salts to and subsequently washing them from soils can be reproduced in the laboratory. The deflocculation of soils [so] treated . . . is intimately associated with the leaching of the NaCl and Na_2SO_4 down into the lower layers of soil by water. In the case of Na_2CO_3 the leaching process is not so essential for the diffusion of the soil colloids. The addition of NaCl, Na_2SO_4, and Na_2CO_3 to the soil when followed with applications of water was particularly effective in diminishing the rate of percolation through the soil so treated. NaCl and Na_2SO_4 in constant contact with the soil increased the rate of percolation, except when a comparatively dilute solution of NaCl was slowly passed through the soil for a considerable period of time.

"The soil treated with NaCl, NaOH, Na_2CO_3 and other salts, followed by leaching with water, yields a suspension in water containing approximately ten times as much solid matter as the same soil washed with water only. A real diffusion in such salt-treated soils seems evident. The soil once diffused by washing out added NaCl requires considerably more salt to completely flocculate it, than does the water-washed soil. Likewise the injured physical condition of such soils is not readily repaired by a second addition of NaCl.

"The portion of the organic matter of the soil known as humus has little or no connection with the appearance of diffusion in salt-treated, water-washed soils. The diffusion in soils treated as described above seems to be closely associated with the direct addition of sodium to or with the absorption of sodium by the soil, thereby producing a new silicate complex of a colloidal character in the soil . . . [which] is formed simultaneously with the interchange of ions occurring between the salt and the soil. The washing process serves, in the case

of neutral salts, to remove flocculating agents. The loss of calcium and magnesium from the soil bears little or no relation to the flocculation appearing in salt-treated, water-washed soils except in so far as it may be a measure of the absorbed sodium. The presence of the OH-ion does not seem to be an essential factor in the diffusion of salt-treated, water-washed soils. Na_2CO_3 and NaOH produce markedly different effects on suspensions of the soil. The acid ion of the salt is not an important factor in the deflocculation phenomena following the washing out of salts from soils. Sodium, potassium, and ammonium seem to produce the colloidal silicate complex when salts of these metals are applied to soils, while calcium does not. Dilute solutions of acids and salts possess flocculating powers on suspensions of the soil. It is not essential in every case to wash all of the salt out in order to bring about diffusion."

How much plant food is removed from soils by crops and drainage water? H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 29 (1915), No. 3, pp. 193–210, fig. 1*).—Lysimeter experiments on swamp soil and so-called white-moss soil are reported, which showed that the losses of nutritive constituents in drainage water were much smaller in pastures than in cereal fields and were greater in swamp than in white-moss soil.

The chemical composition of the hay from the two soils also differed. The swamp hay contained more potassium, phosphorus, and nitrogen than the white-moss soil hay, both on fertilized and unfertilized plats. The lime content was greater in the hay from the limed white-moss soil.

White-moss soil, when completely fertilized, became enriched in potash and phosphoric acid but lost nitrogen in the drainage water. Swamp soil, when completely fertilized, retained phosphoric acid but lost potash and nitrogen. The percentage composition of the soil was, however, but little affected.

Calcium, magnesium, potassium, and sodium in the drainage water from limed and unlimed soil, T. L. Lyon and J. A. Bizzell (*Jour. Amer. Soc. Agron., 8 (1916), No. 2, pp. 81–87*).—Experiments conducted at Cornell University with limed and unlimed clay-loam soil, growing corn, oats, wheat, timothy, and clover, are reported, in which the drainage water resulting from natural rainfall was analyzed twice yearly for five years.

It was found that "of the bases, calcium, magnesium, sodium, and potassium, the last named is most firmly held in the soil used. . . . An application of burned lime corresponding to the lime requirement of the surface foot of soil was not accompanied by any appreciable increase in the quantity of potassium present in the drainage water, [and] did not result in any greater quantity of potassium in the crops raised on the limed soil than in those that grew on the soil that received no lime. So far as could be ascertained . . . there was no liberation of potassium effected by the lime treatment. Magnesium was the only one of the four bases that appeared in larger quantity in the drainage from the limed than from the unlimed soil. The calcium-magnesium ratio is much broader in the drainage water from this soil than in the soil itself. The effect of an annual application of potassium sulphate at the rate of 200 lbs. per acre was to increase materially the quantity of calcium and magnesium in the drainage water, but not to increase the quantity of potassium. The sum total quantity of the bases calcium, magnesium, potassium, and sodium was less in the drainage water of the soil that received an application of lime than in the water from the unlimed soil."

The loss of sulphur in drainage water, T. L. Lyon and J. A. Bizzell (*Jour. Amer. Soc. Agron., 8 (1916), No. 2, pp. 88–91*).—Experiments conducted at Cornell University on a clay loam soil growing five crops, in which the drainage water for four years was analyzed for sulphates, are reported.

It was found that "the sulphur removed in the drainage water from an unplanted, unlimed soil that had received some farm manure but no commercial fertilizer amounted to 44 lbs. per acre annually. The application of lime increased the quantity of sulphur removed by the drainage water. Soil on which crops were grown lost less sulphur in the drainage water than did unplanted soil when otherwise similarly treated. The annual application of sulphate of potash at the rate of 200 lbs. per acre markedly increased the quantity of sulphur in the drainage water. From one-half to two-thirds of the sulphur applied annually as sulphate of potash was removed in the drainage water."

Physicochemical studies of soils.—IV, The cause of the fixation of phosphoric acid by the soil, U. Pratolongo (*Staz. Sper. Agr. Ital., 48 (1915), Nos. 5–7, pp. 457–490. figs. 2; abs. in Chem. Zentbl., 1915, II, No. 17, p. 917*).—Continuing previous work (E. S. R., 35, p. 21). experiments with loose alluvial soils, alluvial clay, humus soil, and calcareous clay soils and monobasic phosphates are reported. The results are taken to indicate that the fixation of phosphoric acid can be attributed to absorption processes by positively charged soil colloids, mainly the hydroxids of iron, aluminum, and manganese, and also to chemical fixation by calcium salts.

The oxidizing power of soils, F. C. Gerretsen (*Arch. Suikerindus. Nederland. Indië, 23 (1915), No. 21, pp. 833–847, figs. 2; Meded. Proefstat. Java-Suikerindus., 5 (1915), No. 11, pp. 317–331, figs. 2; abs. in Chem. Abs., 10 (1916), No. 4, p. 503; Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1583, 1584; Jour. Soc. Chem. Indus., 35 (1916), No. 6, p. 372*).—In tests with 19 cane soils having normal oxidizing power, it was found that when tested before and after sterilization the amount of iodin liberated by the soils from 1 per cent potassium iodid solution decreased noticeably. This is taken to indicate that "in case soils have an oxidizing power it is at least partly due to oxidases." In six cases where the stand of cane was good from 120 to 354 mg. of iodin were liberated by 100 gm. of soil; in three cases where the stand was fair to moderately poor from 79 to 184 mg. were liberated; and in eleven cases where the stand was bad there was no iodin liberated in eight cases and up to 47 mg. in the others. "The amount of gaseous oxygen necessary to liberate the average amount of iodin would amount to 30 to 100 per cent of the pore space in a heavy clay soil. Hence it is concluded that the poor stand of cane on strongly reducing soils is due to lack of oxygen at the root tip."

A method of determining the oxidizing power of soil by means of potassium iodid solution is described.

The principles of crop production, E. J. Russell (*Jour. Chem. Soc. [London], 107 (1915), No. 638, pp. 1838–1858, pl. 1, figs. 9; abs. in Nature [London], 96 (1916), No. 2412, pp. 579–583, figs. 4*).—This is a brief review of work by the author and others in which the main factors influencing crop production are discussed, special attention being drawn to the so-called limiting factor.

Soil survey of Walker County, Alabama, J. O. Veatch, A. M. O'Neal, Jr., and J. F. Stroud (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 30, fig. 1, map 1*).—This survey, made in cooperation with the State of Alabama and issued July 31, 1916, deals with the soils of an area of 510,720 acres in northwestern Alabama, the surface of which is prevailingly undulating to hilly, with small areas of extremely rough and broken country.

"The soils of the greater part of the county are residual in origin, and are derived from shales and fine-grained sandstones. The silt loam and fine sandy loam types of soil predominate. The soils are generally well drained and easily tilled." Exclusive of steep broken land, 12 soil types of 8 series are mapped, of which the Dekalb very fine sandy loam, shale loam, and silt loam, and the

Hanceville silt loam cover 27.3, 21.5, 11, and 14.3 per cent of the area, respectively.

Soil survey of Pennington County, Minnesota, W. G. SMITH, N. M. KIRK, and F. WARD (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 28, pl. 1, fig. 1*).—This survey issued July 15, 1916, deals with the soils of an area of 388,480 acres in northwestern Minnesota, the surface of which is mainly level to undulating, with a general slope toward the southwest. "The natural drainage of the county is for the most part poor and must be assisted by artificial means."

The soils of the county are of glacial origin. Including peat, 9 soil types of 3 series are mapped, of which the Fargo clay loam, Fargo loam, peat, and Benoit loam cover 36.4, 17.3, 17.1, and 14.5 per cent of the area, respectively.

The chemical composition of some Minnesota peat soils, DEF. HUNGERFORD (*Jour. Amer. Peat Soc., 9 (1916), No. 2, pp. 74–81*).—Analyses made at the Minnesota Experiment Station of 28 samples of peat, 10 of which were from the muskeg type and 18 from the grass peat, are reported and discussed.

The muskeg peat, in general, contained a higher percentage of volatile matter than the grass peat, this averaging 86.84 per cent in the former and 73.71 per cent in the latter. The nitrogen content was higher in the grass than in the muskeg peats, the former containing an average of 1.874 per cent and the latter of 2.569 per cent. The percentages of both phosphoric acid and potash were also somewhat higher in the grass than in the muskeg peats.

The greatest difference in composition between the muskeg and the grass peat was found in their lime content, although there was considerable variation in the amount present in different samples of both types. The muskeg contained on the average 1.237 per cent of lime, but different samples varied from 0.25 per cent to 5.97 per cent. The grass peat contained 3.35 per cent as an average, and varied from 1.03 to 14.36 per cent.

The analysis is taken to indicate that Minnesota peat soils resemble but do not agree exactly in composition with those of European countries.

The soils of Mississippi, W. N. LOGAN (*Mississippi Sta. Tech. Bul. 7 (1916), pp. 84, pl. 1, figs. 15*).—This is a revision and an enlargement of Technical Bulletin 4 of the station (E. S. R., 29, p. 416), to which a brief discussion of the general properties of soil and chapters on soil acidity and its correction and on geological formations from which the soils were derived have been added.

Soil survey of Dunklin County, Missouri, A. T. SWEET, B. W. TILLMAN, H. H. KRUSEKOPF, C. E. DEARDORFF, W. I. WATKINS, and E. W. KNOBLE (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 47, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station and issued August 8, 1916, deals with the soils of an area of 343,040 acres in southeastern Missouri which consists topographically of hill lands, bench lands, including sandy ridges and glade lands, and low bottom lands subject to overflow.

"Nearly all parts of Dunklin County have been drained directly or at least greatly benefited through the drainage of low-lying adjacent areas. . . . The most important soils . . . are the sandy terrace or 'sand-ridge' soils."

Twenty-four soil types of nine series are mapped, of which the Sharkey clay and the Lintonia fine sandy loam and fine sand cover 21.1, 15.2, and 14.8 per cent of the area, respectively.

Soil survey of Roger Mills County, Oklahoma, J. A. KERR, J. H. AGEE, and E. C. HALL (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 32, fig. 1, map 1*).—This survey, issued July 11, 1916, deals with the soils of an area of 726,400 acres in the Great Plains region in western Oklahoma.

The surface consists of a high rolling plain, deeply dissected by flowing streams. The topography of the plain is undulating to gently rolling, while that of the lowland is hilly. Including rough broken land and dune sand, 22 soil types of eight series are mapped, of which the Vernon clay loam and very fine sandy loam cover 19 and 9.2 per cent of the area, respectively, rough broken land 11.8, and the Richfield fine sandy loam 10.1 per cent.

Soil survey of Lancaster County, Pennsylvania, B. D. GILBERT, W. B. COBB, E. L. MOFFITT, and J. F. COX (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 70, fig. 1, map 1*).—This survey, made in cooperation with the Pennsylvania College and Station and issued July 21, 1916, deals with the soils of an area of 602,240 acres in southeastern Pennsylvania which "consists of a central valley or lowland occupying about 50 per cent of its total area, surrounded on all sides by highland, except where narrow belts of the lowland project from the main area and extend to or beyond the county line." The regional drainage is mature and complete.

The soils of the county are residual and alluvial in origin and the loams and silt loams predominate, including rough stony land and meadow. Thirty-six soil types of 17 series are mapped, of which the Hagerstown silt loam and the Manor loam cover 24 and 20.6 per cent of the area, respectively.

Soil survey of Brazos County, Texas, J. O. VEATCH and C. S. WALDROP (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 53, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station and issued July 10, 1916, deals with the soils of an area of 369,920 acres in east-central Texas lying in the Gulf Coastal Plain. The topography is level to gently rolling and the greater part of the county is well drained.

The county "embraces a rather wide range of soils, having peculiar differences in texture, structure, drainage, or other characteristics, which . . . affect in some degree crop yields and the ease or difficulty of cultivation. . . . Two general groups are recognized, (1) the upland soils and (2) the bottom land and terrace soils. The upland soils are mainly derived from underlying sedimentary deposits. The bottom and terrace soils are alluvial." Thirty soil types of 13 series are mapped, of which the Lufkin and Susquehanna fine sandy loams cover 40.3 and 11.3 per cent of the area, respectively.

Soil bacteriology, C. M. HUTCHINSON (*Rpt. Agr. Research Inst. and Col. Pusa, 1914–15, pp. 79–89; Ann. Rpt. Bd. Sci. Advice India, 1914–15, pp. 110–116*).—Continuing work previously reported (E. S. R., 33, p. 513), it was found in studies of bacteriotoxins in soils that "the inhibition of nitrification occurring in soils under water-logged or semianaerobic conditions was not due merely to lack of oxygen required for formation of the completely oxidized product, but to the action of toxins resulting from the activity of certain classes of bacteria which rapidly multiply under these conditions. . . . It was found that such toxins result from decomposition of organic nitrogen compounds by bacterial action under semianaerobic conditions, and further proof that the inhibition of nitrification is not due merely to shortage of oxygen was afforded by the observation that, with the same air supply as was sufficient for complete nitrification of ammonium sulphate in soil, nitrification of oil cake containing the same amount of nitrogen was completely inhibited. . . .

"It was found in actual practice in the field that germination in a soil which had been water-logged was interfered with and that the ensuing crop was consequently poor, nor was this remedied by application of nitrate of soda, although the use of superphosphate was successful. Laboratory experiments showed that rapid reduction of nitrate takes place in water-logged soil, a large proportion of nitrite being formed. . . . It was found in the laboratory that superphosphate

had a neutralizing action upon the toxicity to bacteria of extracts of certain soils, and this was traced to the free acid. . . .

"Ammonification proceeded at the normal rate in soil under semianaerobic conditions and was apparently not interfered with by the bacteriotoxins produced, although the activity of such ammonifiers as *Bacillus mycoides* is actually lowered by the presence of B. X. This latter organism does not appear to be universally present in soils. No concentration of ammonia above that in the aerated control was found, nor was this gas given off by the anaerobic soil."

In a special experiment to test the action of the carbon dioxid formed in soil by bacterial action upon nitrification in that soil, it was found that " under partially anaerobic conditions absorption of the carbon dioxid produced no effect upon nitrification in soil, either of oil cake or of ammonium sulphate. . . . Complete nitrification of ammonium sulphate took place under semianaerobic conditions in which no nitrification of oil cake occurred. . . .

" It was found that salts of some of the heavy metals, such as copper, had a decided influence in neutralizing the toxic action toward seedlings of extracts of soils kept under anaerobic conditions."

In studies of nitrification " grass has been found to prevent entirely accumulation of nitrate in the soil in which it is growing. . . . The optimum amount of organic matter as oil cake containing 5 per cent of nitrogen for nitrification in Pusa soil was found to be about 1 per cent of soil weight. . . . The effect of temperature on nitrification in Pusa soil was tested, the optimum being found to be near 35° C. (95° F.). No nitrate was formed at 40°, nor did nitrification take place in soil which had been kept at 40°, when its temperature was afterwards reduced to 30°."

Experiments to determine the cause of the rise and sudden fall of the rate of carbon dioxid evolution when solid bacterial foodstuffs are added to live soil indicated that this result " was due in part to auto-intoxication by the soil bacteria and in part to the purely physical facts of the case."

The progress of green-manuring experiments and studies of Azotobacter, to be reported on elsewhere later, is also noted.

The humification of the constituents of plant organisms and the effect of natural agents upon it, A. Trusov (Trouseff) (*Selsk. Khoz. i Lfiesov., 247 (1915), Apr., pp. 575–605; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 11, pp. 1453, 1454*).—Separate studies of the processes of decomposition of the different constituents of plant organisms and of various mixtures of these constituents, including carbohydrates with proteins, fats, pigments, tannic and encrusting bodies, gums, glucosids, and organic acids, are reported in an effort to throw light on the genesis of humus. Decomposition was studied both as it occurs on the soil surface and within the soil.

It was found that " lignin, proteins, starch, chlorophyll, tannic bodies, phlobaphenes, some fats, and gums are the direct sources of the humus formed from plant residues on the surface of the soil. Cellulose, hemicellulose, monosaccharids and disaccharids, glucosids, and organic acids (including amidoacids) do not give rise to humus under these circumstances. In view of the considerable amount of proteins contained in bacteria, the possibility of the transformation of the bodies of bacteria into humus may be admitted. In the case of fungi this transformation has been confirmed. . . .

"All the organic constituents utilized by micro-organisms for their nutrition may, by means of their bodies containing nitrogen, become indirect sources of humus. Typical black humus is rapidly formed only when all of the following constituents together take part in its formation: Lignin, proteins, pigments,

and tannins. In a greater length of time it may also be formed by the mixture of lignin and proteins and also by the latter alone. A certain correlation is observed between the artificial and the natural formation of humus, in that in natural surroundings humification is restricted to those organic bodies which readily undergo a similar transformation under the influence of very active chemical agents. Humus can not be always identical in its chemical composition, but must contain the decomposition products of lignin, proteins, pigments, tannic substances, etc."

Humus acids in the light of the results of recent investigations, E. Gully (*Internat. Mitt. Bodenk., 5 (1915), Nos. 3, pp. 232–247; 4, pp. 347–368; abs. in Ztschr. Angew. Chem., 28 (1915), No. 77, Referatenteil, p. 487*).—The author reviews the work of others bearing on the subject and reports the results of new experiments on the degree of acidity of different substances, including dopplerite and beech leaves.

A comparison of the acidity of the substances before and after extraction of the bases showed evidences of the action of colloids. The results are taken to indicate that all plants contribute to the acidity of humus. No direct relation was found between the acid content of moor substances and the process of peat formation. The acidity stood in inverse proportion to the plant food content. The natural humus acids were found to form neither soluble alkali nor insoluble lime salts. It is thought that the previously formed humus acids in living sphagnum are identical with the so-called humus acids.

Report on experiments with bacterized peat or humogen, F. J. Chittenden (*Jour. Roy. Hort. Soc., 41 (1915), No. 2, pp. 305–326, figs. 2*).—Five series of pot and plat experiments are reported. The purpose was to determine the influence of additions of bacterized peat on the growth of various flowers and vegetables.

It was found that plant growth was greatly and uniformly increased by bacterized peat in the indoor pot experiments, in which the material was used at rates of 1 part of peat to 1, 3, and 7 parts of soil and the soil was watered with a bacterized peat extract. Much less favorable results were obtained in the outdoor plat experiments. In comparative lots 20 tons of barnyard manure per acre gave better results than 1 ton of bacterized peat. The full results were obtained from the use of peat only when the supply of water was abundant. "The results on the whole show that when prepared under the best conditions bacterized peat is capable of acting as a very effective manure."

The effects of radio-active ores and residues on plant life, M. H. F. Sutton (*Reading, Eng.: Sutton & Sons, 1915, Bul. 7, pp. 20, figs. 9*).—This is a report of a second series of experiments conducted during 1915, in which the results of the 1914 experiments (E. S. R., 34, p. 821) are reviewed and the results obtained with nine different radio-active materials when used on tomatoes, potatoes, radishes, lettuce, onions, carrots, vegetable marrows, and spinach beets, and on fruit, roots, foliage, and bulbs are reported.

"The experiments indicate no more hope of the successful employment of radium as an aid to either horticulture or agriculture than did the trials carried out in 1914." It is considered conclusive that the farmer and gardener need look for no material benefit from radium, the chief result having been to emphasize the value of barnyard manure and complete artificial fertilizers.

Experiments with green manures and green manuring on sandy and white moss soils at Flahult, H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 29 (1915), No. 4–5, pp. 326–338, figs. 3*).—Experiments on the reclamation of sandy and white moss soils deficient in plant food, especially nitrogen, and having a low moisture retaining capacity are reported. The rotation included rye, potatoes, carrots, and different legumes.

Blue lupines gave the most favorable results, being better than yellow lupines. Alfalfa appeared to be a failure as a green manure on these soils. The data from several years' experiments are reported in tabular form.

The displacement by water of the nitrogenous and mineral material contained in leaves, G. André (*Bul. Soc. Chim. France, 4. ser., 17 (1915), No. 23, pp. 429–441; abs. in Chem. Abs., 10 (1916), No. 6, p. 796*).—Experiments with chestnut leaves are reported.

Analyses of 100 leaves on October 17 and of 100 more on the following April 21, which had wintered on the ground, showed a loss of 7.5 per cent of the nitrogen, 67.4 per cent of the phosphoric acid, and 87.7 per cent of the potash. Dead leaves after wintering in piles on the ground were found to contain about twice as much nitrogen and about the same amount of phosphoric acid as a good farm manure. The nitrogen did not nitrify as readily as that of manure.

To determine the influence of water alone, leaves were covered with water together with a few drops of formalin. The solution was decanted, replaced by more water, and the solutions analyzed. The last portion, after 255 days extraction, contained 6.27 per cent of the total nitrogen, 74.14 per cent of the total phosphoric acid, and 94.58 per cent of the potash. This is taken to indicate that the nitrogen of the leaves exists as a protein which does not readily hydrolyze. It was further observed that the younger the leaf, the larger were the percentages of nitrogen, phosphoric acid, and potash extracted in the first week.

The same experiments were conducted with reference to sulphur, lime, and magnesia content. After immersion for one month in water it was found that 56.8 per cent of the total sulphur, 50.72 per cent of the magnesia, and only 20.03 per cent of the lime were displaced.

Report on ten years' experiments with sewage fertilizers, Kuhnert (*Mitt. Deut. Landw. Gesell., 31 (1916), No. 16, pp. 253–258*).—Field experiments on several different German experimental fields of swampy sand soil with cabbages, rye, oats, potatoes, and clover to determine the fertilizing value of stable manure, peat and sewage mixture, and soil and sewage mixture when applied in amounts of about 22 tons, 18 tons, and 13 tons per acre are reported. The peat and sewage mixture used in one case contained 0.44 per cent total nitrogen, 0.23 per cent water-soluble phosphoric acid, and 0.35 per cent potash; and in a second case 0.65 per cent total nitrogen, 0.28 per cent water-soluble phosphoric acid, and 0.31 per cent potash. The soil and sewage mixture used contained 0.39 per cent total nitrogen, 0.01 per cent soluble phosphoric acid, and 0.14 per cent potash.

In all cases the plats treated with sewage fertilizers produced an increase in crop over the unfertilized plats, in some cases exceeded the plats fertilized with stable manure, and gave on the average as good results as plats receiving complete artificial fertilization. It is considered inadvisable and unprofitable to use raw sewage for a fertilizer. Mixing with peat or earth in amounts double the amounts of sewage used was found to be a better practice.

Solubility of plant-food elements as modified by fertilizers, C. A. Jensen (*Jour. Amer. Soc. Agron., 8 (1916), No. 2, pp. 100–105*).—Continuing previous work (E. S. R., 35, p. 321), experiments on a field of sandy loam soil, supporting a growth of sugar beets but which had previously been in alfalfa for several years are reported, showing the seasonal changes in the water-soluble nutritive constituents in the soil and the effect of fertilizers on the amounts of the various elements recovered. The fertilizers were applied at the following rates per acre: "Nothing; nitrate of soda, 300 lbs. at time of planting and 300 lbs. when the beets were thinned; calcium cyanamid, 500 lbs.; superphosphate, 500 lbs.; bone meal, 500 lbs.; factory waste lime, 15 tons; composted manure, 14

tons; ordinary dry yard manure, 14 tons; and yard manure, 14 tons plus 300 lbs. ammonium sulphate."

It was found that "the plats receiving composted manure showed nearly twice as much water-soluble potash in the surface foot as any of the other plats. The seasonal averages of this element were not influenced by any other fertilizer treatment. There was a general decrease in the quantity of water-soluble potash from the middle of May till about the middle of July. After that time, the quantity increased to approximately the amount found earlier in the season.

"Plats receiving nitrate, superphosphate, and composted manure all showed less water-soluble phosphoric acid than the checks. None of the fertilizer treatments resulted in a marked increase in water-soluble phosphates, though cyanamid, bone meal, and manure plus ammonium sulphate caused a small increase. The variation in water-soluble phosphorus from week to week was less than that of any other element measured.

"Taking account of the sulphur added in the various fertilizers, none of the treatments apparently had any marked influence in rendering the sulphates in the soil more soluble in water. There was a decrease in the amount of soluble sulphates from the early part of the season till the latter part of July, corresponding in general to the seasonal decrease in soluble potash.

"The amounts of water-soluble manganese were very small and disappeared entirely after the middle of June. The plats receiving nitrate, composted manure, waste lime, and manure plus ammonium sulphate, showed the highest manganese content. It is remarked . . . that the sugar beets grown on plats showing the highest amounts of water-soluble manganese and sulphur gave the highest yields and the most sugar per acre."

New experiments on the action of lime nitrogen, A. Stutzer and W. Haupt (*Jour. Landw., 63 (1915), No. 4, pp. 385–387*).—Pot experiments with oats and white mustard on soil consisting of equal parts of loam and quartz sand are reported, the purpose of which was to determine the fertilizing value of the nitrogen compounds of lime nitrogen which were insoluble in water. The residue resulting from treatment of lime nitrogen with an excess of water and with sufficient hydrochloric acid to produce an acid reaction in the solution was used. One kg. of lime nitrogen yielded 24.1 gm. of insoluble residue containing about 7 per cent of nitrogen. This was used in amounts equivalent to 0.8 gm. of nitrogen per pot.

It was found that the nitrogen was well utilized by mustard, the utilization in one case being unexpectedly high. The same results were obtained with oats. These results are taken to indicate that this part of the lime nitrogen does not decrease crop yield.

Accumulated fertility in grass land in consequence of phosphatic manuring, II, W. Somerville (*Jour. Bd. Agr.* [*London*], *22 (1916), No. 12, pp. 1201–1209, pl. 1*).—In a second report on these experiments (E. S. R., 32, p. 331), it was found that "when basic slag is used on grass land the increase of herbage, or of meat or milk, does not represent the whole of the benefits. Concurrently with such increase there is improvement in the fertility of the soil. . . . The extent of the accumulation of fertility depends on the amount of slag used, on the period of time during which it acts, and on the way in which the land responds to it. . . . The fertility that is accumulated seems to be largely due to nitrogen stored up by leguminous plants, though increase in nonleguminous humus is probably not without influence. Residues of slag appear also to play some small part in the result."

The action of potash fertilization on the water requirements of plants and on the water content of soil, C. von Seelhorst (*Jour. Landw., 63 (1915), No. 4, pp. 345–356*).—The work of others bearing on the subject is reviewed and

pot experiments, in which 1 gm. each of kainit and a 40 per cent potash salt were added to 100 gm. of soil, are reported.

The results obtained by others and the original experimental results are taken to indicate that potash fertilization decreases the water requirement of plants. Potash fertilization with kainit on a large scale, however, does not increase the moisture content of soil in the summer months, since the moisture absorbed from moist air by the hygroscopic salt is again evaporated from the soil into dry air.

The hygroscopicity of various potassium fertilizer salts, H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 29 (1915), No. 4–5, pp. 382–401, figs. 3*).—Experiments with kainit and 20, 37, and 40 per cent potassium salts are reported.

Kainit and the 20 and 37 per cent salts, after storage from three to six months in sacks, contained a few lumps, and the 40 per cent salt contained a few lumps not passing the 4 mm. sieve. After nine months' storage in sacks, kainit was damp at the top and quite wet at the bottom. It formed one lump which was, however, dry. The same was observed with the 20 per cent salt. The 37 per cent salt stood in small damp lumps. The 40 per cent salt stood in even smaller lumps, but was all damp. In all cases the sacks were wet and had to be cut open.

Tests of the availability of different grades of ground limestone, L. B. Broughton, R. C. Williams, and G. S. Frazer (*Maryland Sta. Bul. 193 (1916), pp. 31–45*).—Experiments on the solubility of limestone and oyster shells of different grades of fineness in water and water charged with carbon dioxid and in a soil solution, and experiments on $\frac{1}{20}$-acre plats of sandy loam soil to determine the influence of different sizes of ground limestone and oyster shells on wheat and crimson clover, are reported.

It was found that "ground limestone and oyster shells of different degrees of fineness vary in their degree of solubility in water and water charged with carbon dioxid [and in soil solution] according to the fineness of the material. . . . In order to furnish as much soluble calcium, by the use of ground stone or ground shells to a soil as calcium oxid will furnish, the stone or shells must be ground so that at least 90 per cent will pass an 80-mesh sieve. . . . Ground limestone, when ground to pass an 80-mesh sieve, gives yields equal to and sometimes greater than calcium oxid."

It is concluded that "better results will be obtained by using calcium oxid (lime) or limestone and oyster shells ground to pass an 80-mesh sieve than by using a coarser grade of limestone or shells. However, marked increases will be noted by the use of large quantities of coarse material, due in a large measure to the fine material that is found in any limestone after it has been ground."

Tabulated analyses of commercial fertilizers, W. Frear (*Penn. Dept. Agr. Bul. 277 (1916), pp. 55*).—This bulletin contains the results of actual and guarantied analyses and estimated valuations of 371 samples of fertilizers and fertilizing materials collected for inspection in Pennsylvania from August 1 to December 31, 1915.

[List of fertilizer and lime manufacturers and importers and their products] (*Penn. Dept. Agr. Bul. 275 (1916), pp. 42*).—This bulletin contains a list of 184 fertilizer and lime manufacturers and importers and licensed brands of their products, together with the text of the Pennsylvania fertilizer law.

The international movement of fertilizers and chemical products useful to agriculture (*Internat. Inst. Agr. Rome, Internat. Crop Rpt. and Agr. Statis. 7 (1916), No. 3, pp. 177–221*).—This review, issued in March, 1916, is the fourth of a series (E. S. R., 34, p. 426) and gives figures for the fertilizer production and trade for 1913, 1914, and 1915. Data are also given for imports and exports of sulphur for the different countries and for the production of copper

sulphate in Europe and North America. No figures are given relating to the production of potash salts in Germany, the tables showing only those amounts delivered for internal trade and export as fixed by the law of 1910.

The wholesale prices of raw phosphate remained practically unchanged in the United States during the seven months ended with February, 1915 (prices are not given for superphosphates). Prices of potash salts were prohibitive from the standpoint of their use as fertilizers during the half year ended with January, 1916. There was a steady increase in the price of sodium nitrate during the same period. Prices of ammonium sulphate fluctuated, but were substantially the same at the end as at the beginning of the half year.

A bibliography of 445 references to recent literature on the subject of fertilizers is appended.

AGRICULTURAL BOTANY.

Annual periodicity in plants, G. Lakon (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 2–3, pp. 85–101*).—From investigations discussed the author concludes that an inherent annual periodicity in woody plants does not exist as such, but that this, as seen in nature, is the result rather of external influences on the tree. The plant is claimed to have the capability to grow continuously under certain conditions, or under other conditions to experience a resting period.

Rhythmic alternation of growth and rest in plants, G. Lakon (*Biol. Centbl., 35 (1915), No. 10, pp. 401–471*).—The article above noted has been followed up with a more extended discussion and bibliography. The evidence is claimed to support the conclusion that the development of periodicity, like that of the plant itself, is dependent principally upon the occurrence of external conditions favorable thereto.

Energy transformations during the germination of wheat grains, Lucie C. Doyer (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci., 17 (1914), pt. 1, pp. 62–70*).—From investigations on germinating wheat, the author has concluded that the loss of energy and evolution of heat both show a great increase during the germination of wheat grains, especially about the third day. The evolution of heat depends greatly on the surrounding temperature, the optimum being about 35° C. (95° F.). The total loss of energy during germination at 20° exceeds the loss of energy by evolution of heat at the same temperature.

The influence of frost and light on the germination of seeds, W. Kinzel (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 10, pp. 433–468*).—Later results are given of experimentation previously noted (E. S. R., 33, p. 343) testing influences bearing on germination, particularly the effect of frost and light as shown by representatives of a large number of plant families, together with a bibliography of the subject.

Germination as related to illumination, E. Lehmann (*Ztschr. Bot., 7 (1915), No. 9, pp. 560–580*).—The author has followed up the contribution of Gassner (E. S. R., 35, p. 524), with a critical review of recent literature on the relation of light to germination. Some experimental data in tabular form obtained recently by Ottenwälder in connection with the author are included.

On the mutual influence of phototropic and geotropic reactions in plants, C. E. B. Bremekamp (*K. Akad. Wetensch. Amsterdam, Versl. Wis en Natuurk. Afdeel., 23 (1914–15), pt. 2, pp. 1241–1255; also in ditto, Proc. Sect. Sci., 17 (1914–15), pt. 2, pp. 1278–1291*).—The tests here described refer to the summation of phototropic and geotropic curvatures, changes in the phototropic and geotropic reactions under the influence of light, and changes in the geotropic and phototropic reactions under the influence of gravity.

It is stated that the reactions of Avena to gravitational stimuli and to light stimulation of small intensity do not noticeably influence each other. By varying the duration and the intensity of illumination, modifications were produced; namely, the reversal of the direction of curvature and a change in the rate of reaction.

Determination of cell sap concentration by the freezing point method, G. J. BOUYOUCOS and M. M. MCCOOL (*Jour. Amer. Soc. Agron., 8 (1916), No. 1, p. 50*).—In the present brief note attention is called to the fact that as a result of the successful application of the freezing-point method in a study previously reported (E. S. R., 34, p. 721), this method can now be employed to investigate many other problems. It is stated that the determination of the concentration of the plant cell sap can be accomplished directly in the plant without extracting it by crushing the plant tissue, placing it in the freezing tube, inserting the thermometer, and following the procedure described. The results of the considerable work already done have fulfilled anticipations, inasmuch as the concentration of the cell sap is greater when determined directly in the plant than after extraction.

The transpiration coefficients of cultivated plants, N. TULAIKOV (TOULAÏKOFF) (*Zhur. Opytn. Agron., 16 (1915), No. 1, pp. 36–76, figs. 4; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 6, pp. 813–815*).—This is an account of the study at the Besentchuk Agricultural Experiment Station during 1910 to 1914, in the culture house and in the open, of the transpiration coefficient or the amount of water necessary to form a unit of dry matter.

The results, which are tabulated, are considered to show that the variations of the transpiration coefficient of a given plant are sometimes larger in different years than for different species in the same year. The numerical coefficient in the open was about twice as large as that in the culture house, but its volume depends upon meteorological conditions in the same way as in the former case. Early sowing gives a large crop and a low transpiration coefficient, late sowing a high transpiration coefficient but a lessened crop. The coefficients of wheat and oats in rows are lower than in the same crops sown broadcast. In 1914 the largest crops of summer wheat and oats corresponded to the lowest water consumption.

Assimilation of carbon dioxid by plants, P. N. RAIKOW (*Chem. Ztg., 39 (1915), No. 105, pp. 657–659; abs. in Jour. Chem. Soc. [London], 108 (1915), No. 637, I, pp. 1047, 1048*).—A theory herein set forth intended to explain the assimilation of carbon dioxid by plants is based largely on the properties of chlorophyll and the presence of an oxonium compound. According to this view, the oxygen liberated is probably derived one-half from carbon dioxid and one-half from water.

Importance of glycogen and starch as intermediate products in the transformations induced by certain organisms, H. I. WATERMAN (*Chem. Weekbl., 12 (1915), No. 24, pp. 552–556; abs. in Jour. Chem. Soc. [London], 108 (1915), No. 633, I, p. 630*).—Details are given of an investigation of the percentages of invert sugar, sucrose, and starch present in bananas dried at temperatures between 45° and 105° C.

Recent studies on the chemical and histological characters of radish cultivated in the presence of sugar, M. MOLLIARD (*Rev. Gén. Bot., 27 (1915), No. 318, pp. 161–168, pls. 2, figs. 2*).—Studies pursuant to those previously reported (E. S. R., 19, p. 932), employing sugar solutions of different strengths, show resulting alterations, which are described, in tissue structure and cell content.

The relation between amylase and sugar content in resting potato tubers, J. Bodnár (*Kisérlet. Közlem., 18 (1915), No. 4, pp. 788–795, No 1*).—This work is said to have shown the presence of maltase in resting potato tubers. The activity of amylase in resting tubers shows a correspondence with the presence of nonreducing and total sugars, certain exceptions being noted. It is stated that tubers which possess amylase of high activity either produce much sugar or exhibit intensive respiration.

Zymase and carboxylase in potato and sugar beet, J. Bodnár (*Bot. Közlem. [Budapest], 14 (1915), No. 3–4, pp. 122–124; abs. in Bot. Centbl., 129 (1915), No. 23, pp. 597, 598*).—From potato tubers and beet roots the author was able to obtain zymase in stable and active condition. In its presence the bacteria in diseased plants changed alcohol to acetic acid.

Oxidation of alcohol by seedlings, W. Zaleski (*Biochem. Ztschr., 69 (1915), No. 3–4, pp. 289–293; abs. in Jour. Chem. Soc. [London], 108 (1915), No. 633, I, p. 630*).—In pursuance of former work (E. S. R., 28, p. 428), the author reports the results of his recent studies on cereal and legume seedlings. This is claimed to support the view that alcohol is oxidized in the growth of these seedlings under the conditions here employed. It is not claimed, however, to have been shown that alcohol is a normal intermediate product of plant metabolism.

Protein transformations in yeast.—II, Influence of the medium on protein formation, W. Zaleski and W. Schataloff (*Biochem. Ztschr., 69 (1915), No. 3–4, pp. 294–304*).—Information given previously (E. S. R., 31, p. 223), regarding the influence of aldehyde on post-mortem changes in yeast has been followed up with a detailed account of studies on the effects in this connection of alcohols and phenols, of the relation of the medium, and of the influence exerted by other substances. Some of the work is still in progress and caution is suggested regarding broad generalizations in this connection.

The influence of nitrates on the development of root tubercles, A. J. Ewart (*Jour. Dept. Agr. Victoria, 13 (1915), No. 12, pp. 759, 760*).—In order to test the statement, frequently made, that the addition of soluble nitrates to the soil decreases by a kind of compensatory action the formation of root tubercles by legumes, experiments were carried out with *Vicia faba* in double and in single rows, employing sodium and potassium nitrates. Allowing for vitiation of the results by heavy rainfall in case of the double rows, it is concluded that although the nitrates used did not appreciably diminish the formation of root tubercles, their use as manures in the case in question would have been highly unprofitable, the plants being able to gain all the nitrogen they required from supplies already present in the soil.

The influence of manganese on the growth and ash composition of potato, Š. Sijfert (*Věstnik 5, Sjez. Čes. Lék. Přír., 1915, p. 411; abs. in Bot. Centbl., 129 (1915), No. 15, pp. 376, 377*).—It is stated that the use of manganese results in an increase of the potato crop and in the nitrogen content thereof, but in a decrease of starch. Though sulphates were present in the fertilizer, very little sulphur trioxid was to be found in the ash.

The occurrence of hematoid iron compounds in plants, I, II, G. Gola (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 12, pp. 1239–1243; II, No. 6, pp. 289–294*).—Organic compounds of iron were found so generally distributed in very diverse groups of plants as to suggest their universal occurrence in this connection. The necessity for more intimate study of the part played by iron in the physiology of respiration is suggested.

Chondriosomes in fungi and algæ, A. GUILLIERMOND (*Rev. Gén. Bot., 27 (1915), Nos. 319, pp. 193–207, pls. 2, fig. 1; 320, pp. 236–253, pls. 2; 321, pp. 271–288, pls. 3, fig. 1; 322, pp. 297–315, figs. 2*).—Continuing work previously noted (E. S. R., 32, p. 524), the author states that chondriosomes have been found in a large number of fungi, in which they appear to be generally present. In some algæ it was impossible to demonstrate their presence, but the chloroplast, which is here highly differentiated, shows some chemical and histological characters proper to mitochondria and may consist of fine fibrillar mitochondrial substance, as physiologically it seems to play the rôle appropriate thereto and may be considered as a sort of mitochondrial reticulum. In the Cyanophyceæ the chondriosome, as such, appears to be completely wanting, but it appears to be more or less completely replaced functionally by the nucleus. The physiological rôle of the chondriosome appears clearly evident in case of fungi, as they produce vesicles which are claimed to be absolutely analogous to those which produce starch in the higher plants.

The bibliography appended includes titles of 19 contributions by the author.

Division in mitochondria and their relations with the phenomena of secretion, F. MOREAU (*Compt. Rend. Soc. Biol. [Paris], 78 (1915), No. 6, pp. 143, 144; abs. in Bot. Centbl., 129 (1915), No. 23, pp. 593, 594*).—Considering the three views regarding the origin of mitochondria which are more commonly held, namely, that they result directly from a protoplasmic differentiation, that they are of nuclear origin, and that they arise from preexisting mitochondria, the author prefers the last mentioned, citing studies more particularly relating to certain algæ and fungi. It is held that each chondriosome arises from one previously existing, but that mitochondria destined for division do not secrete, and those which do secrete do not divide.

The formation of crystalloids of mucorin in mitochondria, F. MOREAU (*Compt. Rend. Soc. Biol. [Paris], 78 (1915), No. 7, pp. 171, 172; abs. in Bot. Centbl., 129 (1915), No. 23, p. 594*).—It is stated that in portions of *Sporodinia grandis* and *Rhizopus nigricans* mucorin crystalloids are observed to originate and increase in granular mitochondria.

Internal uredinia, J. F. ADAMS (*Mycologia, 8 (1916), No. 3, pp. 181, 182, pl. 1*).—Noting instances previously recorded of deviations from normal development, the author reports another aberrant case in the production of internal uredinia by *Nigredo caryophyllina* (*Uromyces caryophillinus*) in the leaves of *Dianthus caryophyllus* in the greenhouse of the Pennsylvania State College. The deviation here noted from the usual method is thought to represent an abnormal rather than a typical condition.

Asexual hybridization, L. DANIEL (*Rev. Gén. Bot., 26 (1914), No. 308, pp. 305–341, figs. 8; 27 (1915), Nos. 313, pp. 22–29, figs. 10; 314, pp. 33–49, pls. 3, figs. 6*).—After a review of observation and opinion regarding graft hybrids, the author reports on his own more recent observations with four asexual graft hybrids. These have been studied somewhat in detail as regards their characters, both external and internal, at different stages. It is considered as of theoretical and practical importance that occasionally this form of hybridization gives rise to characters not previously possessed by either of the stocks concerned in its formation.

Variation in Cosmos bipinnatus, B. LONGO (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), II, No. 9, pp. 408–410*).—A descriptive account is given of the variation observed for two consecutive years in the generations of *C. bipinnatus*.

Seashore thicket formation by Prunus spinosa, H. DEVAUX (*Rev. Gén. Bot., 27 (1915), No. 320, pp. 225–235, pl. 1, figs. 2*).—A description is given of some

striking effects as regards position and contour produced by wind action in connection with growth and death in thickets of *P. spinosa* in exposed situations on the seashore.

Differences in resistance of plants to injurious influences, F. STRANÁK (*Věstnik 5. Sjez. Čes. Lék. Přír., 1915, p. 425; abs. in Bot. Centbl., 129 (1915), No. 15, p. 378*).—Important phases of the resistance of plants to attack are their anatomical structure (as mechanical tissue or impregnation with silica), morphological characters (as thickness of stems in cereals), chemical constituents of the plant body (as silica or lime), and vegetative period.

The effects of illuminating gas on plants, P. SORAUER (*Landw. Jahrb., 48 (1915), No. 2, pp. 279–312, pl. 1, figs. 2*).—Previous investigations (E. S. R., 26, p. 532) have been followed up with a study of the various effects of illuminating gas in the soil on several sorts of wild or cultivated plants, largely trees. The results are detailed as regards the influences noted, including reactions by the plants. It is thought that, while a number of indications are found which, taken together, may be considered as characteristic of root injury by gas, no single symptom, as for example changes in leaf coloration, can be depended upon as a certain indication of gas injury to roots.

The influence of sulphur dioxid on plants, R. TRNKA (*Věstnik 5. Sjez. Čes. Lék. Přír., 1915, p. 431; abs. in Bot. Centbl., 129 (1915), No. 15, p. 378*).—Plants are said to take up into their active green tissue sulphur dioxid in different proportions. This is thought to form sulphurous or sulphuric acid and to interfere greatly with the formation of vegetable matter.

Secretion by roots of substances toxic to plants, M. MOLLIARD (*Rev. Gén. Bot., 27 (1915), No. 322, pp. 289–296, pl. 1*).—Work previously reported (E. S. R., 30, p. 522) has been followed up by further tests with peas. These are said to show that the plants excrete substances which prove toxic to plants grown thereafter in the medium previously used. The effect was increased after the medium had been twice used.

Injurious effects from ivy growing on trees, C. VON TUBEUF (*Naturw. Ztschr. Forst. u. Landw., 13 (1915), No. 10, pp. 476–481, figs. 5*).—This is a further account, with discussion, of stem constrictions of plants (E. S. R., 31, p. 343).

FIELD CROPS.

Field crops, D. N. PRIANISHNIKOFF (*Uastnoe Zemledielie. Moscow: V. Rikhter, 1914, pp. 513+15, pls. 144, figs. 2*).—This work deals with cereal, root, and leguminous crops, together with other plants grown for oil, fiber, dye, and spice production. Attention is also given to tobacco and other plants used for their narcotic effect. The culture and uses of the different crops are considered in detail and the control of diseases and insect enemies is outlined. The work has reference to the culture of the different crops in Russia.

[Irrigation experiments at Bromberg] (*Jahresber. Kaiser Wilhelms Inst. Landw. Bromberg, 1914, pp. 38–50*).—Potatoes were given 30, 140, and 160 mm. (1.2, 5.6, and 6.4 in.) of irrigation water, applied by sprinkling, in addition to a rainfall of 195 mm. during the growing season. A forage variety, Gertrude, yielded 13,209 lbs. of tubers per acre without irrigation and 15,262 lbs., 15,440 lbs., and 19,099 lbs. per acre when receiving 30, 140, and 160 mm. of irrigation water, respectively. Magnum Bonum, a table variety, yielded 4,462 lbs. with only the natural rainfall and 10,710 lbs. and 10,978 lbs. per acre with 140 and 160 mm. of irrigation water, respectively. On the assumption that both rain and irrigation water was completely used by the plants, it is pointed out that it required on the average of all tests 556 lbs. of water to produce 1 lb.

of dry substance in the tuber. In another experiment, conducted on a heavier soil, it was found that irrigation did not increase the yield of tubers to the same extent as in the experiments just described, which were conducted on sandy soil, and the starch content also was increased to only a very limited extent. The percentage of large-sized tubers in the crop, however, appeared to have been increased considerably as the result of irrigation.

In addition to these trials an experiment was conducted with the use of different quantities of waste water from potash works applied with the irrigation water. Although as high as 1.2 kg. of chlorin were given per cubic meter of water applied, no injurious effects on the growth and yield of the potatoes was observed, but the foliage was considerably lighter in color than the foliage of the plants irrigated with pure water and the crop ripened about three weeks earlier.

Sugar beets received a natural precipitation of 237 mm. from May 1 to September 30, and were given in addition on certain plats either 130 or 220 mm. of irrigation water. The plat irrigated with 130 mm. produced 8,300 lbs. of beets and 3,213 lbs. of leaves more per acre than the plat not irrigated. The use of 220 mm. of water apparently reduced the yield of beets and leaves as compared with the application of 130 mm. The results indicated that it required an average of 334 lbs. of water to produce 1 lb. of dry matter in the beets and foliage.

Irrigation of meadows on light sandy soil by the furrowing, flooding, and furrow-gravity methods gave very satisfactory results, the best yield being secured with furrow-gravity irrigation.

Ten years of variety tests at Dickopshof, A. RICHARDSEN (*Landw. Jahrb., 48 (1915), No. 3, pp. 331–427*).—The soil conditions of the experiment field are described, data with reference to the weather conditions for the different years are tabulated, the crop rotations followed are outlined, and the methods of conducting the variety tests with winter and spring wheats, winter rye, oats, barley, sugar beets, fodder beets, ruta-bagas, and potatoes are discussed. The soil devoted to these tests is described as a deep loam with favorable physical characters, although not especially satisfactory from a chemical point of view. The meteorological observations showed a ten-year average of 9.6° C. (49.1° F.) as the mean daily temperature for the year, an annual sunshine total of 1,107 hours, and an annual precipitation of 695 mm. (27.8 in.). The results are tabulated in detail for the different years and are summarized for different periods.

Of three winter wheat varieties grown for seven years, Strube Club gave an average yield of 3,321 kg. of grain and 5,999 kg. of straw per hectare (49.4 bu. and 5,339 lbs. per acre, respectively). Mette Club yielded on the average 3,161 kg. of grain and 5,830 kg. of straw per hectare. Strube Club also stood first among the varieties grown for periods of six, five, and four years, but ranked second—Mette Club standing first—among 11 varieties tested from 1911 to 1913, inclusive. In a seven-year test the grain produced by the two varieties represented an average of 35.4 per cent of the total yield, while the average liter weight was 760.3 gm., and the average weight of 1,000 kernels 37.709 gm.

From the results secured with spring wheat it is concluded that for the soil conditions of the test, Heine Japhet and Rimpau Red Schlanstedt are of equal value and apparently superior to the other varieties tested, while Krafft Bordeaux, Wohltmann Blue Dame, and Iden are considered promising sorts approaching each other in yielding capacity. In one seven-year test Rimpau Red Schlanstedt, the leading variety, yielded on an average 2,927 kg. of grain and 5,815 kg. of straw per hectare. As compared with the winter wheat varieties, the spring wheat varieties gave a higher average weight per liter

and per 1,000 kernels, but the average percentage of grain as based on the total yield of grain and straw was higher with the winter wheat varieties.

The test of varieties of winter rye showed Lochow Petkus as the leading sort, with Himmel Champagne ranking next, and Sperling Green Kerneled, Krafft Zeeland, and Rümker Yellow Kerneled as promising varieties. In a nine-year test Lochow Petkus produced on an average 2,775 kg. of grain and 5,996 kg. of straw per hectare, while Himmel Champagne yielded 2,630 kg. of grain and 5,674 kg. of straw, but ranked above the other variety in average percentage of grain, liter weight, and 1,000-kernel weight.

The leading variety of oats in tests carried on for six, five, and four years was Strube Schlanstedt, followed by Svalöf Goldregen and Leutewitz Yellow. In the three and two year tests all these varieties fell below Lochow Yellow and Svalöf Siegeshafer. In the six-year test the varieties above mentioned yielded an average of 3,423 kg. of grain and 4,718 kg. of straw per hectare, the proportion of grain to total production being 42.05 per cent, the liter weight 513 gm., the 1,000-kernel weight 28.081 gm., and the proportion of hull in the grain 25.09 per cent.

Varieties of brewing barley were tested for only three years. The average grain production was in favor of Improved Pfalz, yielding 3,821 kg. of grain and 4,804 kg. of straw per hectare. This variety also ranked first in proportion of grain to total yield with 44.45 per cent, in liter weight with 690.5 gm., and in 1,000-kernel weight with 48.39 gm. The average protein content was 11.85 per cent which, although rather high, was nevertheless lower than in any other variety. Nolc Bohemia and Heil Frankengerste stood next in value.

The data secured with varieties of sugar beets indicated in general that a decrease in beet production was associated with an increase in leaf production, not only relatively but also absolutely and as a rule with an increasing percentage of sugar. As a result of this relationship it is pointed out that the sugar production per hectare fluctuates much less than the beet production and the percentage of sugar content. In beet yield the variety Friedrichswerth, among four varieties tested for eight years, ranked first with 42,392 kg. of beets and 29,882 kg. of leaves per hectare. The average sugar content of the beet, 16.22 per cent, was lower than in the other varieties but the average sugar production per hectare, 6,876 kg., was the highest This was also generally true of the results secured in the tests of shorter duration and with a larger number of varieties. For sugar production the varieties Breustedt, Schobbert Specialty 1, and Schobbert Ideal 1 ranked next to Friedrichswerth.

The results with varieties of fodder beets showed that a decrease in beet yield was accompanied by an increase in leaf production, not only in the percentage relation of the leaves to the beet, but also in the production per hectare, and also in general by an increase in dry matter content. It is pointed out that for this reason the dry matter yield per hectare varies less than the beet yield and the percentage dry matter content. Of four varieties tested for nine years, the leading variety, Yellow Eckendorf, yielded an average of 85,913 kg. of beets and 10,966 kg. of leaves per hectare. The average dry matter content of the beet was 11.17 per cent. While this variety was the heaviest yielder of beets, it fell behind the other sorts in dry matter content and dry matter production, the average for the four varieties being 13.52 per cent and 10,314 kg. per hectare respectively. Two varieties, Durana and Veni Vidi Vici, stood well above the average in dry matter production per hectare.

The test with rutabagas was conducted for only three years and limited to only three varieties. The leading variety, Remy Improved Altmark Giant, yielded 65,000 kg. of beets per hectare with a dry matter content of 12.57 per cent.

Study of the root systems of pasture plants on the moor soils of the experiment fields at Flahult and Torestorp, H. Osvald (*Mitt. Ver. Förd. Moorkultur Deut. Reiche, 34 (1916), No. 4, pp. 62–76, figs. 10*).—Observations made on the depth and distribution of the root systems of white clover, timothy, meadow foxtail, Kentucky bluegrass, meadow fescue, red fescue, and orchard grass growing on lowland and upland moor soils were supplemented by studies of the root anatomy.

On the upland moor meadows at Flahult a dense and heavy root growth occurred in the upper 5 cm. (2 in.), in the next 25 cm. the growth was very thin, while below 30 cm. practically no roots were found. The lowland moor meadows of Torestorp showed a dense and heavy root development in the upper 15 to 20 cm. which gradually became thinner as it extended to the depth of 45 cm.

The results of the anatomical studies indicated that roots from moor soils are less densely constructed, have larger intercellular spaces, and lignify more slowly than roots produced in sandy soil. The larger intercellular spaces which always occur in such grasses as meadow foxtail, and meadow fescue, and timothy are produced much earlier on moor soils and often are found even in very young roots. This is considered due to the inadequate supply of oxygen in the soil and this behavior of the plant as an effort on its part to provide aeration. The absence of root nodules on clover is regarded as further evidence of the lack of oxygen in the soil. On the upland moor soils at Flahult, nodules are found only in the upper 2 or 3 centimeters. The results are taken as showing plainly that on moor soils only a very thin surface layer serves as the source of moisture and nutrients to meadow plants.

Several methods of laying down cultivated land to meadow, S. Rhodin (*K. Landtbr. Akad. Handl. och. Tidskr., 54 (1915), No. 7, pp. 569–582; Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 115 (1915), pp. 16*).—Three different methods of seeding cultivated land to timothy and clover were compared. The seed mixture used consisted of 3 kg. of red clover, 6 kg. of alsike clover, and 21 kg. of timothy per hectare (2.67, 5.34, and 18.69 lbs. per acre). In all cases oats was used as a nurse crop. In one instance the clover and timothy seed was mixed with the oats and the whole sown on smoothly harrowed soil at the rate of 175 kg. per hectare; in another instance the seed mixture was sown on smoothly harrowed land before the nurse crop; and in the third on unharrowed land and after the nurse crop, the land being then smoothed down with the harrow.

The best results were obtained from sowing the seed mixture before the nurse crop. It was also found that covering the clover and grass seed not more than 1.5 cm. (about 0.6 in.) proved most satisfactory.

Corn culture in the Southeastern States, C. H. Kyle (*U. S. Dept. Agr., Farmers' Bul. 729 (1916), pp. 19, figs. 11*).—This publication makes recommendations and suggestions regarding the preparation of land for corn, the use of commercial fertilizers in corn culture, and the planting and cultivation of the crop, applicable mostly to the cotton-growing sections of North Carolina, South Carolina, Georgia, Florida, and Alabama.

Cotton, H. Semler (*O Algodão. Rio de Janeiro: Min. Agr., Indus. e Com., 1914, pp. 110, figs. 40*).—This is a popular treatise on the cotton industry, including a botanical and historical review of the plant, directions for its culture, a description of ginning and other processes of preparing the crop for the market, and statistical notes on the production of cotton for different years and countries.

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Observations on the blossoming of hemp, G. HAVAS (*Kisérlet. Közlem., 18 (1915), No. 5–6, pp. 908–919, pls. 2, figs. 3*).—Hemp plants were grown in the open in 1913 and observations were made every fourth hour from 4 a. m. until 8 p. m. during the blossoming period.

It was observed that in both the staminate and pistillate plants blossoming began at one of the upper nodes on the stem and progressed gradually upward. In vigorous plants with branches from the lower nodes, the progress of blossoming was both upward and downward from the initial blossom, while on the branches themselves the opening of the buds proceeded toward the point. The blossoming of the male plants progressed in such a way that the buds at the ends of the main stem and branches all opened at the same time. The male flowers were found to develop on the leafless portions of the floral axis and the female flowers grouped in pairs in the axils of the leaves. Late-appearing and subordinate branches as a rule bore no flowers. It was further observed that under identical conditions female flowers sometimes reached the receptive stage before the male flowers were ready to supply the pollen. It is stated that in Hungary pollen distribution generally begins during the first half of July, continuing from four to six weeks; that plants may be in blossom from three to four weeks, and that several thousand blossoms may develop on a single plant. The dehiscence in the staminate flowers took place to the greatest extent during the night and early morning. The development of individual buds from blossoming to pollination required about seven hours.

Sorghum vulgare and S. halepense, G. C. DUDGEON (*Min. Agr. Egypt, Agr. Prod. No. 1a (1915), pp. 32*).—A general article in encyclopedic form, dealing with *S. vulgare*, under the principal headings of its botanical description, history, cultivation, value of the crop, uses of the grain, leaves, and stalks, areas and yields, prices and returns, food value, sweet sorghum, and broom sorghum. With regard to *S. halepense* only brief notes on botanical relationship and its culture are presented.

Sudan grass, N. SCHMITZ (*Maryland Sta. Bul. 194 (1916), pp. 47–62, figs. 7*).—A general discussion of Sudan grass culture in Maryland is presented and the results of cultural and other tests with the crop are reported.

In 1913 better yields on soils of high and medium fertility, 4.4 and 3.3 tons per acre, respectively, were secured from sowing on June 13 than on earlier and later dates. The average results for three years indicated that under favorable soil conditions 15 lbs. of good seed is sufficient for securing a satisfactory stand. Sudan grass and soy beans as a mixed crop gave the best yield when the Sudan grass was sown at the rate of 15 lbs. and the soy beans at the rate of 6 pks. per acre. The composition of Sudan grass hay, cleaned seed, and straw is given in a table and compared with the composition of other common forage crops. In a digestion test with a bull, coefficients were obtained of 60.6 per cent for dry matter, 35.4 for protein, 41.2 for fat, 50 for crude fiber, and 62 per cent for nitrogen-free extract.

Studies of variation and correlation of weight and sugar content of beets, especially of sugar beets, W. ÖTKEN (*Ztschr. Pflanzenzücht., 3 (1915), No. 3, pp. 265–333, figs. 2*).—This article deals mainly with the study of correlation between individuals and between the averages of groups of plants. The results obtained are tabulated in detail and discussed at some length.

The conclusions based on the data accumulated are drawn with reference to the present status of sugar-beet breeding. Belief is expressed in the existence of a series of factors influencing the increase in sugar content either directly or indirectly, and in the combination of an increasing number of these factors through the continued selection of beets high in sugar or the selection and reciprocal crossing of families readily transmitting their characters. The breed-

ing of families in which external conditions least affected the sugar content unfavorably is considered to have resulted in the final exclusion of a series of factors which under certain conditions cause a reduction of the sugar content, and this, in conjunction with the gradual fixation of the characters positively determining a higher percentage of sugar, has reduced in the course of time the variability of the sugar content of the beet. The author states that it has been shown repeatedly that the sugar content increases with the intensity of culture, and that for this reason the richest beets are still produced in the long and well established beet-growing centers. He further states that possibilities present themselves to increase the yield of beets as well as the percentage of sugar without detriment to either the one or the other character.

Further conclusions based on the data in hand, but with reference only to heritability, are drawn and presented by T. Roemer, who points out that external conditions have a marked influence on the growth of sugar beets in general, but that the weight of the beet as compared with its sugar content is affected to a greater extent and that its latitude of variation is also the greater. For this reason the increase in weight is regarded as more difficult of achievement than the increase in sugar content, as selection based on weight is more likely to include a higher percentage of nontransmissible characters than selection based on sugar content, and the distinction between heritable and nonheritable variations presents greater difficulties. Attention is called to the fact that the transmission of desirable characters is not the same in either individual plants or in entire families, and that in selection for weight and sugar content a certain influence of the mother beet asserts itself. This is largely determined by the family type, so that the performance of the family is of much greater importance in selection than the performance of the individual. It is stated that weight and sugar content as heritable characters act independent of each other, as inheritance of greater weight and higher sugar content may be coincident with each other or undesirable inheritance of one character may be coupled with desirable inheritance of the other.

The relation between the sugar content and chemical characters in the first generation of an individual mother beet, K. ANDRLÍK and J. URBAN (*Ztschr. Zuckerindus. Böhmen, 40 (1915), No 3, pp. 107–113*).—The results of a study of this question indicated that individual beets of the first generation with the same sugar content may vary within the limits of variation in the weight of the root and leaves. The law of correlations appeared operative to only a very small degree with regard to the average sugar content of the roots and their average weight, but seemed of greater significance in connection with the weight of the leaves, as a higher average sugar content was associated with a lower average weight of leaves. It was found that with the same sugar content in the root, the dry matter in the root and leaves varied within the limits recognized for this factor, but that an average low sugar content was generally accompanied by an average low dry matter content in the root and leaves. The ash content of the root and leaves varied in roots of the same sugar content, but in general rose perceptibly in the leaves with a high average sugar content in the root, and vice versa. The data also indicated that with the increase in the average sugar content of the root, the nitrogen content of the root and leaves increases although only to a limited degree.

Tobacco, H. SEMLER (*O. Fumo. Rio de Janeiro: Min. Agr., Indus. e Com., 1914, pp. 131, figs. 19*).—A popular treatise on tobacco including discussions from the historical, botanical, and cultural standpoints. Notes by A. Caire on the development of tobacco culture, the total yields in different countries, and the quantities exported by Brazil in different years are appended.

Tobacco from Cyprus (*Bul. Imp. Inst.* [*So. Kensington*], *13* (*1915*), *No. 4*, *pp. 547–550*).—An article describing a number of samples of Turkish tobacco grown in Cyprus, and giving in this connection the chemical composition of two of the samples.

It is pointed out that some of the samples conform with Turkish tobacco as regards size of leaf but that they contain too much moisture for the English market. It is stated that the excess of moisture caused a rapid secondary fermentioned in the tobacco resulting in dark patches around the midrib.

Frost and wheat, A. H. Cockayne (*Jour. Agr.* [*New Zeal.*], *12* (*1916*), *No. 1*, *pp. 1–10*, *figs. 7*).—This article discusses the fertilization of wheat in its relation to frost injury and reports observations made on the effects of a late frost in New Zealand.

In nearly every case the wheat crops which failed to become fertilized as the result of frost injury were autumn sown. It is pointed out that this was not because of the time of sowing but because the crops happened to be in a critical stage when the frost injury occurred. The wheat crops fully fertilized at the time of the frost and whose flowers had closed again were not damaged at all, while spring sown wheat not yet developed to the stage of fertilization was injured more or less where the frost was most severe. These spring sown crops did not show the complete lack of fertilization seen in those that were on the point of flowering when the frost occurred.

Second annual seed laboratory report, 1914–15, W. L. Oswald (*Minnesota Sta. Bul. 159* (*1916*), *pp. 3–16*, *figs. 4*).—During the year 8,452 samples were sent in for examination and 125 official samples were collected. The results of purity and germination tests are given in tables.

The use of a sunlight germinator in testing grass and flower seeds gave promising results. It was found that many of the grass seeds germinate best in the light. An experiment in testing the germination of seeds in soil and sand in the greenhouse as compared with the chamber tests in the laboratory showed that in nearly every case the laboratory test gave a somewhat higher percentage of germination than was secured in the soil test in the greenhouse.

Weeds and their identification, E. Atkinson (*Jour. Agr.* [*New Zeal.*], *12* (*1916*), *No. 1*, *pp. 32–39*, *figs. 9*).—Descriptive notes are given on capeweed (*Cryptostemma calendulaceum*), hawkweed (*Crepis capillaris*), and hawkbit (*Leontodon hirtus*), as they occur under New Zealand conditions.

HORTICULTURE.

Plant propagation, M. G. Kains (*New York: Orange Judd Co.*, *1916*, *pp. XIX+322*, *figs. 214*).—In the present manual and textbook the author has aimed to bring together the latest information on all branches of practical and theoretical plant propagation with the view of making the work valuable both to the professional propagator and to the teacher of plant propagation.

The successive chapters deal with the following subjects: Germination; germination and longevity of seeds; seed testing; potting; propagation by buds—layerage; bottom heat; cuttage; classes of cuttings; graftage—general considerations; is graftage devitalizing; Daniel's experiments and conclusions; general points concerning fruit tree stocks; stock and scion handling; grafting waxes, wound dressings, etc.; methods of grafting; methods of budding; nursery management; laws affecting nursery stock; and suggested practicums.

Plant propagation in the Tropics, P. J. Wester (*Philippine Bur. Agr. Bul. 32* (*1916*) *pp. 87*, *pls. 12*, *figs. 40*).—In this bulletin the author first discusses the principles and methods of plant propagation with special reference to their application in the Tropics. Directions are then given for the vegetative propa-

gation of tropical and semitropical fruits, tree planting, orchard management, and the control of the more common diseases and insect pests. A list is given of tropical fruits in the Philippines.

[Ornamental and economic plants in the Botanic Gardens], C. K. BANCROFT (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914–15, App. 2, pp. 3–12*).—Notes are given on ornamental and economic plants of various kinds being grown in the Botanic Gardens, Georgetown, British Guiana.

Annual report of the experimental work of the Ganeshkhind Botanical Garden (Poona District) for the year 1914–15, W. BURNS (*Dept. Agr. Bombay, Ann. Rpt. Expt. Work Ganeshkhind Bot. Sta. 1914–15, pp. 47*).—A progress report on cultural experiments, variety tests, and miscellaneous experiments being conducted with fruits and other economic plants in the Ganeshkhind Botanical Garden.

In a college garden, VISCOUNTESS WOLSELEY (*London: John Murray, 1916, pp. XVII+255, pls. 8*).—A popular account of the development and work of the Market Garden School, for women, at Glynde, Sussex.

A second report on the university farm garden, A. L. DACY (*West Virginia Sta. Bul. 156 (1916), pp. 3–22, figs. 5*).—In continuation of a previous report (E. S. R., 33, p. 237) the results secured at the university farm garden for the third season are given, together with an average of the results obtained during the three years 1913 to 1915. The average gross annual receipts for the 3-year period from 4.7 acres were $275.48 per acre Among the crops grown three years were celery with an average annual receipt of $533.22; eggplant, yielding $462.73; and tomatoes, early and late, yielding $405.66 per acre. Cauliflower, which was grown but two years, gave an annual gross receipt of $433.24 per acre.

A master farmer of seventy who grows truck crops and fruit in southern Jersey, H. R. COX (*Country Gent., 81 (1916), No. 26, pp. 1251, 1252, figs. 5*).—In addition to a brief account of operations on a successful fruit and truck farm a table is given containing an analysis of the business of the farm for the fiscal year ended March 1, 1916. One hundred and thirty-three acres of crops grown in that year yielded a labor income of $3,583.

Onions.—Experiments and culture, T. H. WHITE (*Maryland Sta. Bul. 195 (1916), pp. 63–78, figs. 3*).—This bulletin gives the results of a number of miscellaneous experiments with onions conducted over a period of several years, together with directions for onion culture in Maryland.

In variety tests Gigantic Gibraltar grew the largest and made the best yield. Prizetaker, White Victoria, and White Globe all yielded well. Hotbed grown plants on the average produced more bushels per acre than either sets or seeds sown outside. Poultry manure at the rate of 5,000 lbs. per acre, supplemented with 98 lbs. of sulphate of potash per acre, gave an increased yield of 36 bu. of onions over the check. A fertilizer containing 2 per cent potash obtained from muriate produced a better yield than a fertilizer containing either 4 or 8 per cent potash. Rows of onions planted 30 in. apart for horse cultivation yielded only 85.7 bu. per acre as compared with 130.6 bu. for rows 14 in. apart and cultivated by hand.

Composition of tomatoes from blighted vines, W. D. BIGELOW (*Canner, 43 (1916), No. 1, p. 30*).—The author finds that analyses of half-grown fruit which has ripened on a blighted vine are practically identical with those of half-grown tomatoes picked from a healthy vine. Although not any more injurious to health than a green tomato, prematurely ripened tomatoes are considered to be undesirable for use as canning stock on account of the inferiority of the product made from them.

Bordeaux mixture stains removed, M. G. KAINS (*Country Gent., 81 (1916), No. 23, p. 1161*).—Experiments reported by the author indicate that tomatoes and other vegetables stained with Bordeaux mixture may be freed from stain by dipping the vegetables in a solution of acetic acid. In the work here noted, which was conducted with tomatoes, a solution of half a cupful of pure acetic acid to 2 gal. of water was used. The dipped tomatoes were readily cleansed of the newly-formed acetates by passing the fruit under running water.

Report of general fruit committee, J. P. STEWART (*Proc. State Hort. Assoc. Penn., 57 (1916), pp. 15–20*).—In this paper the author briefly reviews some of the more important work of the department of experimental pomology of the Pennsylvania Experiment Station.

The time of blossoming of fruit trees (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1914, pp. 107–116*).—Records for 1914 are given of the flowering dates of individual varieties of fruit trees grown in the plantations and orchards of the National Fruit and Cider Institute, Bristol.

The history of the classification of apples, E. A. BUNYARD (*Jour. Roy. Hort. Soc., 41 (1916), No. 3, pp. 445–464, pls. 4*).—In this paper the author discusses the many attempts that have been made in the past to devise a system of classification for apples. The subject matter is presented for the special purpose of showing wherein such classifications have proved unsatisfactory.

Cultural methods in bearing orchards, J. P. STEWART (*Pennsylvania Sta. Bul. 141 (1916), pp. 3–28, figs. 5*).—In a previous bulletin of the station the results of some of the author's cultural experiments in young apple orchards were reviewed (E. S. R., 33, p. 238). The present bulletin gives the results through the season of 1915 of six experiments started in bearing orchards in 1907–8. The experiments involved a comparative test of mulch, sod, tillage, and cover crop treatments, both with and without fertilizers.

Summing up the results thus far obtained it is found that the mulch treatment reinforced by outside materials has been most efficient in improving the yield, growth, and average size of the fruit in orchards up to about 20 years of age. It has also been most efficient in conserving moisture in all cases that have been determined. For orchards over 20 years of age tillage and cover crops slightly surpassed the mulch treatment, unless it was accompanied by adequate fertilization.

The sod treatment has usually given the lowest results in yield, growth, and average size of fruit in orchards of all ages, except when aided by special conditions. On the other hand, it has excelled in color of fruit and in freedom from blight. Fertilized sod plats have generally given better results than unfertilized plats receiving a mulch or tillage. Both the sod and the mulch treatments require thorough protection against mice.

Tillage has generally done best in the fully matured orchards, where it is especially efficient in stimulating growth. Tillage has done well in the younger orchards when accompanied by proper fertilization. The experiments with tillage as a whole indicate that plowing deeper than 4 in. is probably undesirable and that most of the cultivation should be done with disk harrows, or similar shallow-working cultivators rather than the plow. Cover crops have not proved especially beneficial unless the moisture supply was unusually good or the amount of food added was extra large.

In most of the experiments there has been a very close correlation between growth and bearing, except in the older orchards, when it is often possible to secure more growth than is necessary to maintain the best yields. Two of the experiments indicate that annual crops may be maintained by such biennial bearers as Baldwin and Spy in the presence of ample food and moisture supply, by regulation of the yield in any year to prevent overbearing and by preventing

injury to the root systems. In some cases there has been a very marked correlation between the amount of fire blight and the rate of growth. The greatest damage has occurred uniformly on the trees making the most growth. In view of the fact that weakly growing trees have also been attacked, it appears that it is the intermediate growth that is most resistant to this disease.

With regard to color in apples the author concludes that the red colors in apples are developed primarily by sunlight in the later stages of maturity. Hence conditions favoring either of these factors, such as late picking, open pruning, long growing season, sparse foliage, fully developed fruit, light soils, or sod culture, will increase this color, while all opposing conditions will decrease it. By a proper utilization of one or more of these conditions it is believed that the customary harmful effects on color of heavy tillage or too much nitrogenous fertilizer may generally be overcome.

The size of the fruit is determined chiefly by the moisture supply, hence the cultural methods that conserve moisture most efficiently will normally produce the largest fruit. Other influences of importance are the number of fruits on the tree, supply of plant food, and the temperature and length of the growing season.

Starch in apple trees, W. A. Price (*Ohio Jour. Sci., 16 (1916), No. 8, pp. 356–359*).—An experimental study of the storage and migration of starch in apple trees is reported.

The author finds in substance that "during the dormant period starch reserve is stored in the living cells of the pith, wood parenchyma, and medullary rays of the apple. With approach of spring, starch is found in the tissues of the bark, appearing first in the phelloderm and collenchyma. As the leaves begin to appear starch begins to disappear from the various tissues in order as follows: Bark, wood parenchyma, rays, pith. It is used first from the youngest wood of the branches in the top of the tree, later from the lower portions of the tree, and finally from the roots. A portion of the starch reserve may never be used in the growth of the tree, but remains behind to be included in the heartwood, where it remains indefinitely and renders the wood susceptible to decay."

Stock influence upon vintage quality and other characters of apples, B. T. P. Barker (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1914, pp. 117–127*).—The results are given of analyses made in 1914 of fruit juices from apples growing on different stocks. The data secured confirm the conclusion previously arrived at as to the negligible effect of the intermediate stock on vintage quality (E. S. R., 33, p. 240).

Crown gall and resistant stocks, C. O. Smith (*Cal. Citrogr., 1 (1916), No. 9, p. 14, fig. 1*).—Studies are being conducted at the California Citrus Experiment Station with the view of securing resistant stocks for stone fruits.

Tabular results are here given showing the representative resistant and susceptible species and varieties in the various classes of stone fruits which were subjected to the crown gall by actually inoculating the rapid-growing twigs and branches with pure cultures. Among the almonds inoculated no marked resistance has been found. Stocks of the Domestica and Damson types of plums and certain Asiatic types of apricots showed the strongest resistance. The Golden Beauty variety of *Prunus hortulana* has shown sufficient resistance to be used as a stock for native plums. Among other American species, *P. pumila*, a dwarf stock used to some extent in the Middle West, was also strongly resistant.

The Japanese mountain cherries, wild forms and cultivated races, M. Miyoshi (*Jour. Col. Sci. Imp. Univ. Tokyo, 34 (1916), Art. 1, pp. 175, pls. 23*).—A systematic study of the wild and cultivated forms of Japanese mountain cherries, including descriptions of species and varieties. The descriptive text

is accompanied by a number of illustrations in color of the floral parts and foliage of various forms of cherries, as well as illustrations showing the tree growth.

Peach package tests, season of 1915, J. M. Creelman (*Agr. Gaz. Canada, 3 (1916), No. 3, pp. 222–225, figs. 3*).—Data are given on shipping tests of various types of peach packages conducted under the direction of the Canadian Department of Agriculture in 1915.

The new vine; the hybrid producers, E. Pée-Laby (*La Vigne Nouvelle; Les Hybrides Producteurs. Paris: J. B. Baillière & Sons, 1915, pp. 72*).—An account of the direct bearing hybrid grapes resulting from crosses between American and French species. The introductory chapter describes the principal characters of hybrid producers. The succeeding chapters deal with the cultural value of different color hybrids as well as their resistance to diseases, and the nature of the wines made from them.

The chemical composition of the Chasselas Doré and the advantages of bagging in keeping the grapes fresh, F. Charmeux (*Jour. Soc. Nat. Hort. France, 4. ser., 17 (1916), May, pp. 72–74; June, pp. 90–93*).—In some experiments in bagging grapes here reported it was found that the use of close paper bags not only prolongs the fresh appearance of the bunches but also gives the berries a more uniform quality and development and somewhat increases the sugar content of the grapes.

Official report of the session of the International Congress of Viticulture, San Francisco, Cal., July 12, 13, 1915 (*Off. Rpt. Sess. Internat. Cong. Vit., 1915, pp. 324, figs. 54*).—These proceedings include the following papers, with discussions, delivered at the Congress: The Work of the State Viticultural Commission, by E. M. Sheehan (pp. 19–22); Probable Effect of the Federal Tax on Brandy upon the Horticultural Interests of California, by R. D. Stephens (pp. 23, 24); A Campaign of Wine Education, by H. F. Stoll (pp. 24–29); Early California Wine Industry, by H. Lachman (pp. 29–32); Love of the Vine, by L. J. Vance (pp. 32–35); Grape Breeding, by R. D. Anthony (pp. 35–39); Introduction of Viticulture into the Schools, by A. W. Miller (pp. 39–43); Resistant Vines, by G. C. Husmann (pp. 45–50); Pruning and Training American Grapes, by F. E. Gladwin (pp. 50–62); Commercial Fertilizers for American Grapes, by F. E. Gladwin (pp. 62–68); Phylloxera-Resistant Stocks in California, by F. C. H. Flossfeder (pp. 69–76); *Vitis vinifera* in Eastern America, by U. P. Hedrick (pp. 77–81); Viticulture on the Pacific Coast, by F. T. Bioletti (pp. 81–88); The Vineyards of the Columbia River Basin, by E. H. Twight (pp. 89–91); The Grape in Oregon, by C. I. Lewis (pp. 91–97); Grape Growing in New Mexico, by F. Garcia (pp. 97–102); Grape Growing in Utah, by A. B. Ballantyne (pp. 102–106); Grape Growing in Imperial Valley, by W. E. Packard (pp. 107–110); Grape Anthracnose in America, by C. L. Shear (pp. 111–117); Powdery Mildew of Grapes and Its Control in the United States, by D. Reddick and F. E. Gladwin (pp. 117–125); Studies on *Plasmopara viticola* (Downy Mildew of Grapes), by C. T. Gregory (pp. 126–150); Methods of Preparation and Relative Value of Bordeaux Mixtures, by O. Butler (pp. 151–160); Sulphur Fungicides, by G. P. Gray (pp. 160–174); Grape Insects in California, by H. J. Quayle (pp. 174–181); Phylloxera in California, by R. L. Nougaret (pp. 181–186); The Grape Root Worm (pp. 187–195), The Grape Leafhopper (pp. 195–201), the Grapevine Fleabeetle (*Haltica chalybea*) (pp. 201–209), and The Rose Chafer (*Macrodactylus subspinosus*) (pp. 210–216), by F. Z. Hartzell; the Grape Berry Moth (*Polychrosis viteana*), by W. H. Goodwin (pp. 217–236); Two Destructive Grape Insects of the Appalachian Region, by F. E. Brooks (pp. 237–248); The Engineer's Part in the Advancement of the Viticultural Industry, by E. T. Meakin (pp. 248–253); Some Results of the Practical

Application of Sulphurous Acid and Selected Yeast in the Fermentation of California Wines, 1913 and 1914, by W. V. Cruess (pp. 254–263); A Simple and Rapid Method for the Estimation of Volatile Acid in Wine, by W. V. Cruess and R. W. Bettoli (pp. 263–267); Influence of Composition on Effervescence of Champagne, Preliminary Investigations, by R. W. Bettoli and J. La Belle (pp. 267–275); The Sugar and Acid Content of American Native Grapes (pp. 276–279), and The Composition of Pure Wine from American Native Grapes (pp. 280–287), by W. B. Alwood; Important Factors Governing the Successful Transportation of Table Grapes, by A. V. Stubenrauch (pp. 288–300); The Intelligent Blending of Wines, by H. S. Dewey (pp. 301, 302); A New Utilization of a By-Product of the Grape, by G. Rossati (pp. 303–307); and Relation of the Maturity of the Grapes to the Quantity and Quality of the Raisins, by F. T. Bioletti (pp. 307–315).

The wild blueberry tamed, F. V. Coville (*Nat. Geogr. Mag., 29 (1916), No. 6, pp. 535–546, figs. 10*).—In this article the author briefly reviews the progress that has been made in his cultural and breeding experiments with blueberries (E. S. R., 34, p. 534), and also in the culture of improved forms on the New Jersey trial plantation. On this plantation hybrid seedlings have borne their first commercial crop when only three years old and a crop three times as large when four years old.

Official proceedings of the twelfth annual convention, Michigan State Association of Ginseng Growers, 1916 (*Off. Proc. Ann. Conv. Mich. State Assoc. Ginseng Growers, 12 (1916), pp. 45*).—Various topics dealing with the culture and subsequent preparation of ginseng and goldenseal as discussed at the convention are included in these proceedings.

A preliminary study of Philippine bananas, N. G. Teodoro (*Philippine Jour. Sci., Sect. C, 10 (1915), No. 6, pp. 379–421, pls. 12*).—A descriptive account of the species and varieties of bananas known to occur in the Philippines, in which special attention has been given to the special purposes to which the different varieties are adapted.

[Cacao in British Guiana], J. B. Harrison (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914–15, pp. 26–30*).—The results of manurial and other cultural experiments with cacao in British Guiana are reported.

The experiments, which were commenced in 1900, indicate that in British Guiana under conditions similar to those existing at Onderneeming farm the methods of cultivation leading to the successful growth of cacao are the reduction of shade to the lowest amount compatible with due protection from wind; deep and efficient soil drainage; annually forking the land between the trees without injuring the roots any more than is absolutely necessary; mulching the soil; and manuring the trees with a mixture of superphosphate of lime and sulphate of potash.

Eliminating the drone tree, L. B. Scott (*Cal. Citrogr., 1 (1916), No. 9, pp. 8, 9, 19, figs. 2*).—A popular review of the results secured in California in the improvement of oranges and lemons by bud selection (E. S. R., 33, p. 737; 34, p. 639), including a description of methods employed in making records of the production of individual trees.

The rose annual for 1916 of the National Rose Society, edited by H. R. Darlington (*London: National Rose Society, 1916, pp. VIII+164, pls. 35*).—This comprises a collection of articles on various phases of rose culture, including some general accounts of rose growing in different parts of the British Empire and elsewhere.

A partial list of plants available for various uses in general landscape planting, A. D. Taylor (*Cleveland, Ohio: Author, 1916, pp. 51*).—The plant materials listed in this booklet have been included with special reference to

their use in the Northern and North Central States. Concise information is given relative to the correct use of the more prominent species of trees, shrubs, vines, and perennials in ornamental and landscape plantings.

Ornamental gardening in Florida, C. T. Simpson (*Little River, Fla.: Author, 1916, pp. XIII+198, pls. 40, figs. 3*).—A treatise on the decorative plants adapted to Florida and their cultivation, with suggestions for the ornamentation of Florida homes and grounds.

FORESTRY.

Report of the Maryland State Board of Forestry for 1914 and 1915 (*Rpt. Md. State Bd. Forestry, 1914–15, pp. 77, pls. 7*).—A report on forest activities for the years 1914 and 1915 in which consideration is given to forest fire protection, assistance to owners of woodland, work on the state forest reserves and the state forest nursery, forest and tree planting operations under state supervision, investigational and educational work, and public shade tree work.

The Sequoia and General Grant National Parks, season of 1916 (*U. S. Dept. Int., Off. Sec. [Pub.], 1916, pp. 48, figs. 3*).—A pamphlet of information relative to the forests in these parks, methods of transportation, camp sites, birds, mammals, and fishes occurring there, rules and regulations, and literature dealing with the parks. See also a note by Hill (E. S. R., 35, p. 242).

The Mesa Verde National Park, season of **1916** (*U. S. Dept. Int., Off. Sec. [Pub.], 1916, pp. 48, figs. 5*).—An account similar to the above relative to the Mesa Verde National Park.

Manual of instructions for county forest wardens and district forest wardens and information in regard to the prevention and suppression of forest fires, J. E. Barton (*Frankfort, Ky.: State, 1915, pp. 31*).—Although designed primarily for forest officers this manual contains considerable information of value to the general public in the matter of controlling forest fires.

Forest protection.—I, Protection against animals, R. Hess (*Der Forstschutz. Erster Band: Schutz gegen Tiere. Leipsic: B. G. Teubner, 1914, vol. 1, 4. ed., rev., pp. XIII+537, pls. 2, figs. 250*).—A text-book, manual, and reference work on forest protection. The present edition has been entirely rewritten by R. Beck. The successive parts of the present volume deal in detail with protection against domestic animals, game, and other wild animals, birds, and insects.

Causes determining the forms of trees, P. Jaccard (*Rev. Gén. Bot., 27 (1915), Nos. 321, pp. 257–270, fig. 1; 323, pp. 335–349; 324, pp. 353–374, figs. 2*).—Recent experimental and mathematical investigations are said to have substantially confirmed the conclusion formerly reached (E. S. R., 29, p. 342), and to have shown that the forms of tree trunks, those of *Picea excelsa* in particular, are directly influenced in essential characters, notably in the variations in thickness of the layers of growth, by the exigencies of circulation of water and of nutritive materials. See also a previous note (E. S. R., 34, p. 536). The applicability of the theory of the slow selection of useful variations in this connection is denied.

On the amount of sap discharged by some trees, M. Miyoshi (*Jour. Col. Sci. Imp. Univ. Tokyo, 38 (1916), Art. 1, pp. 14, figs. 4*).—Investigations conducted by the author with two species of trees showing high sap pressure, *Cornus controversa* and *Carpinus yedoensis*, led to the conclusion that it is impossible to secure accurate results relative to the discharge of sap for a longer time than one bleeding period where the usual method of collecting the sap from an auger hole is followed. A local stoppage in the hole is found to take place inevitably, thus influencing the amount of sap flow.

Pinus longifolia. a silvicultural study, R. S. Troup (*Indian Forest Mem., Sylviculture Ser., 1 (1916), No. 1, pp. 126, pls. 33*).—The study here reported is based on personal investigations extending over a number of years in most of the important tracts in which *P. longifolia* forests occur.

The subject matter is presented under the general headings of the distribution, locality, and types of forest; silvicultural characters and requirements; natural regeneration; artificial regeneration; external dangers; fire effects and protection from fire; tending operations; systems of management; and statistical information.

Report on the question of field experiments, with special reference to the execution of tapping experiments on estates, G. E. Coombs (*Agr. Bul. Fed. Malay States, 4 (1916), No. 8, pp. 229–242, figs. 4*).—The purpose of this report is to present to rubber planters a statement of the general principles which should govern field experiments in tapping rubber.

Chief factors influencing the development of sal seedlings, R. S. Hole (*Indian Forester, 42 (1916), No. 7, pp. 335–348, pls. 6*).—A summary of some of the chief results of the study recently conducted at Dehra Dun, relative to the factors influencing the development of sal (*Shorea robusta*) seedlings.

Newfoundland and its forest resources, D. Morris (*Jour. Roy. Soc. Arts, 64 (1916), No. 3310, pp. 439–452; Scot. Geogr. Mag., 32 (1916), No. 8, pp. 353–366*).—An account is given of the forest areas, principal timber trees, and forest industries in Newfoundland.

Structural timber handbook on Pacific coast woods, O. P. M. Goss and C. Heinmiller (*Seattle, Wash.: The West Coast Lumbermen's Assoc., 1916, pp. 289, figs. 38*).—A handbook of information relative to the character, strength, durability, and uses of Pacific coast woods. The strength and durability data are based upon tests conducted by the Forest Service of the U. S. Department of Agriculture and other organizations.

The organization of the lumber industry, W. Compton (*Chicago: American Lumberman, 1916, pp. X+153, figs. 23*).—This comprises an analysis of the influences which have largely determined the recent course and the present level of the prices of lumber in the United States.

DISEASES OF PLANTS.

Plant diseases in England and Wales, 1914–15 (*Jour. Bd. Agr. [London], 22 (1916), No. 10, pp. 931–939*).—This is a statement regarding plant diseases, insect pests, etc., issued in lieu of the annual report, temporarily suspended, of the horticultural branch of the Board of Agriculture.

It is stated that the mild weather in the spring of 1914 induced the summer stages of the American gooseberry mildew at an earlier date than any previously recorded in England and led to an unusually severe attack on the fruit. In 1915, the disease appeared somewhat later and was severe only where long drought had weakened the resistance of the bushes. Timely and proper pruning is supposed to afford complete protection and to benefit the bushes otherwise. This treatment should be carried out in the period between the "soft and the hard condition of the fruit." Fungicides check the disease under favorable conditions, but in no case was it completely killed out by their use. American gooseberry mildew is said to be known in all European countries.

Wart disease is reported to cause loss in over 200 industrial districts. Some potato varieties have now been tested many times and are considered to be completely immune. The number of cases in agricultural districts is very small, but the occurrence of sporadic cases suggests that the disease may be dormant

for a season under certain conditions. Tests with formalin promise little success.

Corky scab is said to be very much localized in England and rare in localities where potatoes are grown in large quantities. In a few cases it has been found in a high degree of intensity, proving as destructive as wart disease. No remedy is known for corky scab, to which every variety of potato appears to be susceptible, but it spreads slowly and does not appear to persist in well cultivated soil.

Silver leaf of plums and apples and apple mildew have been studied to some extent. *Dilophia graminis* has been discovered on wheat in two localities.

Recent observations on diseases of cultivated plants in Bohemia, A. Kutín (*Věstnik 5. Sjez. Ces. Přír., 1915, p. 427; abs. in Bot. Centbl., 129 (1915), No. 15, p. 384*).—Observations are recorded on the appearance in Bohemia for the first time of *Tilletia lævis, Peronospora jaapiana,* and *Typhula graminum,* and the reappearance, after some years, of *Tilletia secalis. Sclerotinia trifoliorum* has been noted in new localities, and *Sphærotheca mors-uvæ* appears to have attained wide if not universal distribution.

Cryptogamic parasites of cultivated plants in and near the Province of Turin in 1913, P. Voglino (*Ann. R. Accad. Agr. Torino, 57 (1914), pp. 159–174; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 6, pp. 881, 882*).—This is an arrangement of the data as collected in 1913 regarding weather and regarding cryptogamic parasites of plants in this region. The diseases noted, while encouraged in some degree by the spring rains, were later held in check by the dryness of the summer season.

Recent contributions to our knowledge of the genus Gymnosporangium, F. D. Kern (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 364*).—The author reviews information regarding the genus Gymnosporangium, supplemental to his previous report (E. S. R., 27, p. 424). Among the more notable points brought out are the reporting of another aecial host outside of the Rosales, the finding of teliospores in the species possessing uredinia, studies of the effects produced by the host on the morphology of the fungi, and active investigations of the species causing diseases of economic importance.

Cultures of Uredineæ in 1915, J. C. Arthur (*Mycologia, 8 (1916), No. 3, pp. 125–141; abs. in Science, n. ser., 43 (1916), No. 1106, p. 363*).—With this report, the fourteenth of a series continued by the author since 1899 (E. S. R., 32, p. 750) on the culture of plant rusts, it is proposed to end the series of investigations.

Besides notes on species giving negative results owing to inadaptation of the racial material used, an account is given of successful cultures supplementing work previouly reported in case of 8 species named and a list of 4 species now reported on for the first time.

White speck disease of leaves, C. von Tubeuf (*Naturw. Ztschr. Forst. u. Landw., 13 (1915), No. 10, pp. 469–475, figs. 3*).—The author describes a peculiar leaf decoloration, which is said to be associated with the absence of chlorophyll, starch, and generally plasma in the palisade cells. The affected areas are small but thick. A list is given of woody plants and one of herbaceous plants known to exhibit this phenomenon.

Further evidence that crown gall of plants is cancer, E. F. Smith (*Science, n. ser., 43 (1916), No. 1121, pp. 871–889*).—This is a paper read before the Washington Academy of Sciences, in which the author presents further evidence that crown gall of plants is cancer, and that cancer in plants, because of its variable form and its bacterial origin, offers strong presumptive evidence both of the parasitic origin and of the essential unity of the various forms of cancer occurring in man and animals.

Concerning certain peculiar tissue strands in a Protomyces gall on Ambrosia trifida, A. STEWART (*Abs. in Science, n. ser., 43 (1916), No. 1106, pp. 365, 366*).—The stems of the great ragweed are said to be sometimes infected by *P. andinus*, causing the formation of large galls. These usually occur just above the ground, but often higher on the stem, sometimes as much as 2 ft. above the galls which are located near the roots. Both kinds of galls have essentially the same histological structure, the deeper portions near the pith having peculiar tissue strands which are similar in some respects to the tumor strands found in certain plants affected with the crown-gall organism. The fact that the abnormalities in the tissues of the host plants are found in or near to the pith indicates that the stems become infected when quite young. This is offered as a possible explanation as to how the upper galls of the stems are produced.

Acid sprays as related to scorching, L. DEGRULLY (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 16, pp. 365–367*).—It is stated that while low concentrations, for example 1 per cent copper sulphate and 0.4 per cent carbonate of soda in Burgundy mixture, are rarely dangerous, the same proportions maintained in higher concentrations may prove very injurious to foliage. With 2 per cent sulphate and 0.9 per cent carbonate, the foliage seldom, if ever, scorches, with 2 per cent sulphate and 0.875 carbonate rarely, while with 2 per cent sulphate and 0.75 carbonate the preparation is very strongly acid, and is not ordinarily to be recommended for use after the blooming period. Bordeaux mixture containing 1 per cent copper sulphate and 0.5 per cent lime (sometimes contaminated by the presence of magnesia) practically always gives an alkaline solution.

The powdery mildews of Avena and Triticum, G. M. REED (*Missouri Sta. Research Bul. 23 (1916), pp. 3–19*).—In previous publications (E. S. R., 21, p. 641), the author showed that the morphological species, *Erysiphe graminis*, consists of a large number of different races. In a subsequent paper (E. S. R., 27, p. 545), the results of infection experiments with the powdery mildew of wheat were given. The present paper gives the results of a large number of additional experiments with *E. graminis* on Avena and Triticum. Seed of these genera was obtained from various sources, 165 varieties of wheat being tested with reference to their susceptibility to the fungus. A great majority of these varieties proved quite susceptible. All of the eight recognized types or species of Triticum contained susceptible varieties, and only a few distinctively resistant varieties were found.

An account is also given of the physiological race of *E. graminis* which occurs on species of Avena. Tests have been made of 41 varieties belonging to 17 species, and a great majority have proved susceptible to the oat mildew. It was also found that the wheat mildew readily passed over to certain species of Ægilops and the oat mildew to *Arrhenatherum avenaceum*.

A Phytophthora on oats, J. McMURPHY (*Science, n. ser., 43 (1916), No. 1111, p. 534*).—The author reports observing on leaves of oats in California a species of Phytophthora which is said to be similar to *P. colocasiæ*. A more extended study, however, is considered necessary to determine the specific rank of the fungus. The markings produced on the oats by the fungus may appear as spots or stripes along one or both margins of the leaf, or as a stripe down the center. The diseased areas become yellowish and then whitish when conidia are abundant. Later these areas, which sometimes have a water-soaked appearance, may become brown or reddish-brown, and the parts shrivel and dry up.

Seed treatment tests, 1914, L. HILTNER (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 13 (1915), No. 6–7, pp. 65–90*).—This deals in considerable detail with experiments carried out in Bavaria during 1914 by steeping seed grain of

winter rye and wheat in solutions containing corrosive sublimate as a protection against Fusarium and other fungi. The variety, degree of attack, germinability, grain weight, and fall and spring conditions are noted in the tables given.

The relation of the seed stock to the control of bean anthracnose and bean blight, J. H. MUNCIE (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 365*).—On account of the failure of fungicides in the control of these diseases and pending the experiments on the growing of seed for Michigan planting in western States where anthracnose is unimportant, the author recommends the planting of varieties of beans of high productivity, so that the losses in ordinary years will be so decreased as not to be burdensome to the industry. Such a variety, it is said, has been found in the Early Wonder, which matures early and is very productive even under severe disease and weather conditions.

Angular leaf spot of cotton, F. M. ROLFS (*South Carolina Sta. Bul. 184 (1915), pp. 3–30, pls. 8*).—An account is given of an investigation of the angular leaf spot of cotton, the first description of which appears to have been given by Atkinson (E. S. R., 3, p. 7). According to the author's investigations, this disease is believed to be common in every cotton-growing State in the Union.

The disease produces angular spots on the leaves, and blackened areas are formed on the stalks and branches. It also attacks young bolls. Young seedling plants usually suffer most severely and in many cases are killed outright. The cause of the disease is said to be *Bacterium malvacearum*, which survives the winter in and on the seed and also on the lint. Delinting the seed with sulphuric acid or treating the seed with hot water at 72° C. for 18 minutes greatly reduced the number of infected plants. Delinting the seed and spraying the plants six times with Bordeaux mixture resulted in the production of 98 per cent of sound plants. This method of treatment would probably be practicable where plants are grown for seed production.

Anthracnose (Colletotrichum lagenarium) a serious disease of cucurbits, J. J. TAUBENHAUS (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 366*).—A preliminary report is given of investigations of anthracnose of watermelons, cantaloups, cucumbers, and other cucurbits. These are said to be seriously affected in Delaware, and similar conditions are reported in New Jersey, Maryland, and Virginia. The disease attacks the fruit, particularly in case of the watermelon, and also causes a serious leaf spot and a blight and canker of the vines. The attacks are severest on the watermelon crop in its second successive year. On this account, growers are forced to practice rotations of six years or longer.

Inoculations have shown that the anthracnose from the watermelon, cantaloup, cucumber, citron, and ornamental gourd is identical, the disease being readily transferred from one host to another. Investigations are said to be in progress to determine the life history of *C. lagenarium*, its relationship to the various hosts, and to other species of Colletotrichum, especially *C. lindemuthianum*.

Potato diseases and their control, E. C. STAKMAN and A. G. TOLAAS (*Minnesota Sta. Bul. 158 (1916), pp. 3–47, figs. 28*).—Descriptions are given of a considerable number of parasitic and nonparasitic diseases of potato, with suggestions for their control. For the leaf diseases, Bordeaux mixture is recommended, while wilt diseases and stem rot may be controlled by roguing fields, by selecting and disinfecting seed, and by rotating crops. Experiments conducted during 1914 and 1915 showed that the average yield of potatoes per acre was increased 56 bu. in 16 fields by seed selection and disinfection. Spraying experiments which have been carried on for seven years gave an average annual increase of 63 bu. per acre of early potatoes sprayed 3 times with Bordeaux mixture or of late potatoes sprayed 4 times.

Potato disease, KORFF (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 13 (1915), No. 8, pp. 109–111, figs. 2*).—Brief reference is made to a leaflet issued by the Institute for Agricultural Botany at Munich, dealing with leaf disease and Phytophthora tuber rot of potato and the control of both these troubles by the timely use of copper sprays.

Marasmius on sugar cane, J. R. JOHNSTON (*Mycologia, 8 (1916), No. 2, p. 115*).—Referring to the description given by Fulton (E. S. R., 19, p. 956) of the fungus designated by him as *M. plicatus*, causing root disease of sugar cane in Louisiana, the author states that his own specimens on sugar cane from Louisiana and Texas answer rather to the description of *M. stenophyllus* (*M. semiustis*), said to have been reported on bananas in many West Indian islands but not before on sugar cane.

Effect of colored light on the mosaic disease of tobacco, G. H. CHAPMAN (*Science, n. ser., 43 (1916), No. 1111, pp. 537, 538*).—The author reports some investigations conducted to verify the conclusions of Lodewijks (E. S. R., 24, p. 648) that blue light offers a cure for the mosaic disease of plants.

The diseased leaves of a number of tobacco plants were covered with hoods composed of different colored cloth, and it was found that when blue light was used there was a suppression of the leaf color variation more or less permanent in character. With a single exception, the treated plants showed no typical symptoms of the disease for at least two weeks after the removal of the hoods. That the disease was, however, not controlled was shown by the inoculation of healthy plants with the juice of the treated plants, as this produced the disease in nearly every case. This is taken to show that the active principle of the disease is present in the apparently normal, fully recovered leaves and that it is highly infectious.

The leaf spot disease of tomato, E. LEVIN (*Michigan Sta. Tech. Bul. 25 (1916), pp. 5–51, pls. 9, figs. 2*).—This bulletin gives the results of experiments on the leaf spot disease of tomato, due to *Septoria lycopersici*, and recommendations for its control. While many investigators have reported this fungus as causing the leaf spot disease of tomato, its parasitism was definitely proved by the author's investigations. The morphological, ecological, and physiological relations of the organism are described at some length, and control measures, which include the planting of clean seedlings in clean soil and thorough spraying with Bordeaux mixture, are recommended.

A canker of apple caused by Plenodomus fuscomaculans, G. H. COONS (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 364*).—A serious canker of apple is said to occur in some orchards in northern Michigan. The canker is characterized by elongated lesions which are commonly accompanied by a checking of the bark into small squares or rectangles. The lesions are said to extend along the limb, commonly on the underside. In the older cankers the killed bark drops off, leaving the bare wood.

The causal relation of the associated organism has been shown by inoculation experiments, and the results of a study of its physiological relations have been previously noted (E. S. R., 34, p. 647). Successful inoculations were obtained on the limbs of Wealthy, Duchess, Jonathan, and Ben Davis apples, as well as on the Hyslop crab. Other standard varieties seem more resistant. The fungus has also been successfully inoculated into pear, small cankers having been formed, but no inoculations have succeeded on apple leaves.

The disease, it is claimed, may be successfully controlled by the means commonly advised for apple canker.

Fungi producing the heart rot of the apple, B. O. DODGE (*Mycologia, 8 (1916), No. 1, pp. 5–15, pls. 4; abs. in Science, n. ser., 43 (1916), No. 1106, p. 366*).—Living apple trees at Litchfield, Conn., are reported as being infected

with *Polyporus admirabilis* during August. Apple trees in the eastern United States are said to be more commonly attacked by another type of Polyporus. *P. galactinus* or *P. spumeus malicola* is the species ordinarily found in old orchards of the New England States, while *P. fissilis* is reported as attacking trees in Virginia.

Monilia on fruit trees, G. Voss (*Flugbl. Samml. Pflanzenschutz, K. Landw. Akad. Bonn-Poppelsdorf, No. 7 (1915), pp. 4, figs. 5; abs. in Bot. Centbl., 129 (1915), No. 22, pp. 574, 575*).—A description is given of symptoms and results of attack on fruit trees by the Monilia forms of *Sclerotinia cinerea, S. fructigena,* and *S. laxa.* Protective measures include the early removal and destruction of all affected parts, including fallen fruits and dead wood.

Apricot fruit spots, J. T. Barrett (*Univ. Cal. Jour. Agr., 3 (1916), No. 8, pp. 346–349, figs. 3*).—Descriptions are given of brown rot of apricot, caused by *Puccinia pruni-spinosæ;* of Coryneum fruit spot, due to *C. beijerinckii;* and of scab or black spot of apricot, caused by *Cladosporium carpophilum.* It is said to be easy to confuse some of these, especially in their early stages.

The reciprocal influence between mycotrophic roots of different plants, L. Petri (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), II, No. 11, pp. 536–539, fig. 1*).—Describing the results of growing oaks and olives in close proximity, the author holds that the injury often observed to be suffered by the olive in this relation may be due to the impoverishment of the soil by the oak or to an eventual root rot caused by a Dematophora developing on the subterranean residues of the oak growths, and not to the proximity of the mycorrhiza on the oak. The possible bearing in this connection of facts previously observed (E. S. R., 26, p. 849) is discussed.

Formalin as a spray against American gooseberry mildew (*Deut. Landw. Presse, 42 (1915), No. 36, p. 329; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 7, p. 999*).—B. Panten of Kazmierz, Posen, reports that a 1 per cent solution of 40 per cent formalin, thoroughly applied in the early spring and again before the period of blooming, effectively controlled American gooseberry mildew.

A new fungicide for use against American gooseberry mildew, J. V. Eyre and E. S. Salmon (*Jour. Bd. Agr. [London], 22 (1916), No. 11, pp. 1118–1125; abs. in Gard. Chron., 3. ser., 59 (1916), No. 1523, p. 132*).—It is stated that an ammonium sulphid solution containing 0.18 per cent of sulphur can be recommended for commercial use on an experimental scale for the purpose of protecting the fruit of gooseberries against the mildew. Lime-sulphur wash should be employed for early sprayings until such time as its use would affect the marketing of the berries, when the ammonium sulphid solution should be substituted. It is stated that solutions of liver of sulphur at the strength usually considered as fungicidal are inefficient against the disease, while concentrations which are fungicidal cause such severe scorching of the gooseberry bushes as to preclude their use in this connection.

Notes on the dying of citrus trees, A. H. Benson (*Queensland Agr. Jour., n. ser., 5 (1916), No. 5, pp. 258–266*).—Concerning the dying of citrus trees in different sections, a progress report made by F. Smith is quoted at some length with comments thereon. The trouble is considered due to causes other than soil conditions, and as more probably parasitic in character, though possibly very complex in origin. Age and living conditions of the trees are discussed in this connection. It is thought possible that irregularity in growth may prove to be very important.

Descriptions are given also of other twig, collar, and root troubles.

Fungi attacking cultivated and wild Orchidaceæ and their control, G. LINDAU (*Gartenflora, 64 (1915), Nos. 21–22, 23–24; Orchis, 9 (1915), Nos. 7, pp. 171–178; 8, pp. 181–203*).—Descriptive lists are given including many Uredineæ, Ascomycetes, and imperfect fungi attacking orchids in many widely separated regions of the world.

Black canker in young chestnut trees and nurseries, G. BRIOSI and R. FARNETI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 24 (1915), I, No. 2, pp. 98–105; abs. in Internat. Inst. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 4, pp. 637, 638*).—It is stated that black canker may attack not only adult chestnut trees but also very young plants and even germinating seed, so that a considerable epidemic of this disease may occur in the nursery. The disease is said to be due to infection and not to soil exhaustion.

Studies on diseases of oak, E. MÜNCH (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 11–12, pp. 509–522, figs. 6*).—Previous reports (E. S. R., 24, p. 52) are followed up by an account of a study of *Polyporus igniarius*, the cause of white rot of oak, more particularly as regards its rate of progress in canker formation and the different rates of progress in cambium, bast, and sapwood.

Monograph on oak mildew, F. W. NEGER (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 11–12, pp. 544–550, figs. 2*).—The article previously noted (E. S. R., 33, p. 745) is here supplemented by an account of tests with the Oïdium causing oak mildew on species of Rubus, from which the author concludes that under appropriate conditions a fungus may flourish and even produce spores on a host normally foreign thereto, and that on the basis of studies involving such cases errors of identity may be promulgated. The overwintering of oak mildew is also discussed.

A new disease of walnuts, H. MEMMLER (*Gartenwelt, 19 (1915), No. 53, pp. 623, 624, fig. 1*).—A nut spot of walnut is described as apparently new, but the cause of the trouble has not yet been determined.

Note on western red rot in Pinus ponderosa, W. H. LONG (*Mycologia, 8 (1916), No. 3, pp. 178–180*).—Reporting on the study of the heart rot of western yellow pine, called western red rot in order to distinguish it from a very similar heart rot called red heart or red rot (*Trametes pini*) common in many species of conifers, the author states that the western red rot has three developmental stages. The first shows reddish to dark brown areas in the heartwood which is still firm, the second a whitish or gray color with more or less delignification, and the third a disappearance of much of the heartwood and a very brittle condition of the particles which remain.

This fungus never forms the brown, woody, perennial fruiting bodies on living pine trees that *T. pini* does but forms annual fruiting bodies which usually develop as white encrusting layers on the underside of logs. The pileate form of the fungus resembles very closely *Polyporus ellisianus* (*Tyromyces ellisianus*) and is thought to be specifically identical therewith. The rot is very common throughout the western yellow pine regions of Arizona and New Mexico, and is known to occur in Vermont, New Jersey, Washington, Idaho, and South Dakota.

The fungus enters the living tree, passing through the sapwood, then the heartwood of dead branches, then down into the heartwood of the living tree. During the black jack stage, *i. e.* when not over the age of 150 years, the trees are practically free from this rot. It is, however, exceedingly common in the older trees on account of the dead branches, this factor favoring a short forest rotation. Thin soils on steep southern or eastern slopes, where growth conditions are poor, seem to encourage western red rot.

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Laboratory tests on the durability of American woods.—I, Flask tests on conifers, C. J. Humphrey (*Mycologia, 8 (1916), No. 2, pp. 80–92, pl. 1*).—This work has been in progress for about three years. In most cases both heart and sap wood were used. The blocks cut from logs brought to the laboratory green were placed in flasks, and inoculated plentifully with bean-pod cultures of *Lentinus lepideus*, and kept 4, 8, or 12 months. The results are tabulated and some are discussed.

The order of resistance in case of the highest three, as measured by the smallness of loss in weight by the heartwood during 12 months, was California juniper (3.3 per cent), white cedar (5.4 per cent, sapwood 7.7 per cent), and white pine (8.8 per cent). The loss for both heart and sap wood of fir, spruce, hemlock, and most of the pine during this period ranged within or around 60 to 70 per cent.

Further tests on heartwood of some of the species are considered necessary before safe comparisons can be made.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A history of British mammals, G. E. H. Barrett-Hamilton and M. A. C. Hinton (*London: Gurney & Jackson, 1916, vol. 2, pt. 18, pp. 553–600, pls. 3, figs. 2*).—A continuation of the Muridæ of the Rodentia, previously noted (E. S. R., 35, p. 252), in which the harvest mouse (*Micromys minutus*) and the black or ship rat (*Epimys rattus*) are considered.

Rats and rat riddance, E. H. Forbush (*Agr. of Mass., 62 (1914), pp. 169–251, pls. 12, figs. 19*).—This account deals somewhat at length with the biology of rats, their economic importance, and the various means by which they may be held in check.

Description of a new pine mouse from Florida, A. H. Howell (*Proc. Biol. Soc. Wash., 29 (1916), pp. 83, 84*).

Fumigation of animals to destroy their external parasites, W. Moore (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 71–80, figs. 2*) —The author has met with success in the fumigation of animals with nitrobenzene, the insects being killed without injuring the host.

Report of the entomologist of the Arizona Commission of Agriculture and Horticulture for the year ended June 30, 1915, A. W. Morrill (*Ariz. Com. Agr. and Hort. Ann. Rpt., 7 (1915), pp. 9–50, pls. 6, figs. 18*).—The first part of this report (pp. 9–26) relates to the inspection of plant, fruit, and seed importations; the provision for the terminal inspection of plant products shipped by parcel post; inspections of orchards, nurseries, and fruit products of the State; alfalfa weevil protection; and insect control and eradication. The second part (pp. 27–46) consists of notes on the important insects of the year under the headings of pests of deciduous fruits and vines, citrus and olive pests, pests of field and forage crops, vegetable crop pests, cotton pests, and a range plant pest (*Trirhabda canadensis*). Part 3 (pp. 47–50) describes two vegetable pests to be guarded against, namely, dodder, a menace to the alfalfa seed-growing industry, and citrus canker.

Among the more important insects mentioned are the steel-blue grapevine flea-beetle (*Haltica carinata*), which was an important pest in the Salt River Valley during the spring; the clover mite, which did some damage to almonds in an orchard near Mesa, Ariz.; the flat-headed apple-tree borer, which was unusually destructive to peach, apricot, and plum trees in the Salt River Valley; the wheat or flower thrips (*Frankliniella tritici*), which was particularly injurious to blackberries and found also in the blossoms of the olive in the spring of 1915; two walnut borers (*Prionus californicus* [?] and *Euzophera æglæella*);

the common alfalfa grasshopper (*Melanoplus differentialis*), the three-cornered alfalfa hopper (*Stictocephala festina*), and the clover stem borer in alfalfa; the Mexican moth borer (*Diatræa lineolata* [?]; billbugs injurious to sugar cane (*Sphenophorus phœniciensis*); the potato stalk borer which is becoming of increasing importance in southern Arizona; the two-spotted red spider (*Tetranychus bimaculatus*); the cotton leaf miner (*Bucculatrix thurberiælla*); a capsid closely related to the tarnished plant bug; etc.

First biennial report State Crop Pest Commission of West Virginia, March 1, 1913, to June 30, 1914, W. E. Rumsey et al. (*Crop Pest Com. W. Va. Bien. Rpt. 1 (1913–14), pp. 132, figs. 38*).—This consists of the report of the state entomologist, and discussions of inspection work; nursery registration; cedar rust eradication in Berkeley County; distribution, abundance, injury, etc., of periodical cicada in 1914; control of apple and peach tree borers; chestnut blight eradication work, etc. Several bulletins issued by the commission, viz, (1) State Crop Pest Law, Rules and Regulations of the Commission; (2) Orchard Inspection, Apple Rust, Chestnut Bark Disease; (3) The San José Scale; and (4) The Periodical Cicada in West Virginia in 1914 and The Green Apple Aphis and Other Plant Lice are included. The text of a proposed crop pest law to supersede the present statutes is appended.

Insects in the Virgin Islands, H. A. Ballou (*Agr. News [Barbados], 15 (1916), No. 361, pp. 74, 75*).—A brief account based upon a collection of insects made by the curator of the experiment station in the Virgin Islands.

Insect pests of plants, Northern Territory of Australia, G. F. Hill (*Bul. North. Ter., Aust., No. 13 (1915), pp. 16*).—A brief account is given of the more important insect pests of plants in Northern Territory, Australia, including a description of the life history, natural enemies, and methods of control of each.

Insects infesting the cotton plant in Trinidad, F. W. Urich (*Bul. Dept. Agr. Trinidad and Tobago, 15 (1916), No. 1, pp. 18, 19*).—This paper briefly considers eleven species of insects, their common names, natural enemies, economic status, and control measures.

Some insects of Solanum carolinense and their economic relations, M. P. Somes (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 39–44*).—The author reports observations of the sudden development of the berytid bug *Jalysus spinosus* as a serious pest of the tomato. Previous to this time *S. carolinense* had served as its food plant. It is stated that during the past two years this insect has worked widely through Missouri and in some districts where tomato raising for canneries is of importance has occasioned serious loss.

Sesia rileyana occurs in large numbers on *S. carolinense.* Boring into the central part of the stem it works downward to the roots, and passing down one of the main branches at about the time it matures bores out of the root into the soil. A test transfer of larvæ from the horse nettle to tomato and potato succeeded.

A tortoise beetle (*Cassida pallidula*), a tingitid bug (*Gargarphia solani*), the potato stalk borer, the fleabeetles *Epitrix fuscula* and *E. cucumeris,* the common sphingids *Phlegethontius carolina* and *P. quinquemaculata*, and a lygæid bug (*Ischnodemus fallicus*), which attack cultivated crops, are reported as occurring on *S. carolinense.*

Rhodesian citrus pests, R. W. Jack (*Rhodesia Agr. Jour., 13 (1916), Nos. 1, pp. 69–83, pls. 3; 2, pp. 215–233, pls. 6*).—A brief summary of the insect enemies of citrus in Rhodesia and measures for their control.

Lepisma saccharina (?); its life history and anatomy and its gregarine parasites, J. W. Cornwall (*Indian Jour. Med. Research, 3 (1915), No. 1, pp. 116–131, pls. 6*).—Accounts of the biology of the common silver fish of India and of two distinct gregarines parasitic in its gut.

A new Physothrips (Thysanoptera) from Uganda, with a note on Physothrips antennatus, J. D. Hood (*Canad. Ent., 48 (1916), No. 4, pp. 130–132, fig. 1*).

Heliothrips hæmorrhoidalis injurious to ornamental plants in the Province of Buenos Aires, Argentina, C. Lizer (*Agronomia [Buenos Aires], 6 (1915), No. 36–38, pp. 9–11, figs. 3; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 11, pp. 1549, 1550*).—The author records injury to *Pelargonium peltatum* and *Lagerstrœmia indica* by this thrips.

Eradication of the bedbug by superheating, W. A. Ross (*Canad. Ent., 48 (1916), No. 3, pp. 74–76*).—This paper records the extermination of *Cimex lectularius* from a 2-story, 8-room frame house, heated with a hot-air furnace and kitchen and parlor stoves, in which the temperature of three of the rooms was raised as high as 140, 158, and 162° F., respectively. Very satisfactory results were obtained, the pest being fully eradicated and the house furniture not damaged to the slightest degree. It is thought that the temperature obtained was unnecessarily high and that the superheating would have been equally effective if the temperature had been maintained between 120 and 130°.

Life history notes on Apateticus cynicus and A. maculiventris, R. D. Whitmarsh (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 51–53*).—These notes relate to the biology, including the predatory habits, of two stink bugs. The former, the largest and most common predacious species, unlike the latter, is single brooded.

The distribution of the periodical cicada in Ohio, H. A. Gossard (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 53–59, figs. 3*).—A report of the present distribution of the broods of 1906, 1914, and 1915 in Ohio.

Notes on the tomato psylla, H. Compere (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 5, pp. 189–191, figs. 3*).—These notes relate to the biology and control of *Paratrioza cockerelli*, found by the author infesting the Jerusalem cherry (*Solanum capsicastrum*) at Sacramento and San Francisco. The solanums at the latter place were rendered worthless.

Concerning problems in aphid ecology, Edith M. Patch (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 44–51*).—A discussion of some of the important ecological problems.

The present state of our knowledge of the biology of the vine phylloxera, B. Grassi (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 10, pp. 1269–1290*).—This article reviews the status of knowledge of the biology of the grape phylloxera previous to 1905, and discusses the advances resulting from researches made since that date and the question as to the existence of different races of phylloxera.

Modern views of the control of the vine phylloxera, B. Grassi (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1553–1571*).—The author discusses the importance of control and methods usually employed, the method of control in Italy, the advisability of continuing the campaign, the manner of dispersal of the phylloxera, and the proposed method of control.

A nematode parasite of root aphids, J. J. Davis (*Psyche, 23 (1916), No. 2, pp. 39, 40, fig. 1*).—The author reports having found apterous viviparous and oviparous individuals of a new species of Anœcia infested with nematodes at West Lafayette, Ind.

Two newly-established scale insects, E. O. Essig (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 5, pp. 192–197, figs. 6*).—The camellia scale (*Pulvinaria floccifera*) and the dictyospermum scale (*Chrysomphalus dictyospermi*) are reported to have recently become established in limited districts in California.

On the structure and biology of Tachardia lacca, with observations on certain insects predacious or parasitic upon it, A. D. Imms and N. C. Chatterjee (*Indian Forest Mem., Forest Zool. Ser., 3 (1915), No. 1, pp. 42, pls. 8*).—Historical notes are first given, followed by a discussion of the systematic position of this coccid, the secretion and chemical composition of lac, its life history, distribution in India, and chief food products, together with descriptions of its several stages, habits, insect enemies, etc. A bibliography of 29 titles is included.

The rice stem borer in the Konkan, R. S. Kasargode and V. G. Deshpande (*Dept. Agr. Bombay Bul. 69 (1915), pp. 18, pl. 1*).—This is a detailed account of *Schoenobius bipunctifer*, a lepidopteran which occurs throughout the greater part of the Indian rice area. It is the source of a large percentage of the insect injury to rice, which is rarely less than 10 per cent of the crop and may be as high as 60 per cent. The caterpillar attacks the plant at some point in the stem, which soon withers and turns white. Six days are required for its embryonic development, 27 for the larva, and 9 for the pupa, or a total of 42 days for the life cycle.

Climate and variations in the habits of the codling moth, E. P. Felt (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 107–110*).—It is the author's opinion that, if conditions obtaining in New York during the past two or three years are reliable criteria, climatic differences exert a considerable influence upon the habits and the type of injury caused by the codling moth.

Notes on crambids, G. G. Ainslie (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 115–119*).—Miscellaneous notes relating to the methods of rearing, etc., of crambids.

The control of the grape berry worm (Polychrosis viteana), W. H. Goodwin (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 91–106*).—Substantially noted from another source (E. S. R., 35, p. 358).

Preliminary studies of the biological control of the grapevine pyralid (Œnophthira pilleriana), F. Schwangart (*Naturw. Ztschr. Forst u. Landw., 13 (1915), Nos. 8–9, pp. 380–408; 11–12, pp. 522–541*).—The first part of this paper (pp. 380–398) deals with parasites of *Œ. pilleriana*, particularly the dipterans *Prosopodes fugax*, *Nemorilla maculosa*, *Gymnoparea* (*Actia*) *pilipennis*, and *Cyrtoneura stabulans*. The second part (pp. 398–408, 522–534) consists of a discussion of the parasites of Hyponomeuta and their relation to the vine leaf rollers (*Œ. pilleriana*, *Clysia ambiguella*, and *Polychrosis botrana*), and the third part (pp. 534–541) comprises conclusions, etc.

The pilotaxy of Anopheles, S. R. Christophers (*Indian Jour. Med. Research, 3 (1915), No. 2, pp. 362–370, pl. 1*).—This article deals with the more important chætæ of Anopheles.

The male genitalia of Anopheles, S. R. Christophers (*Indian Jour. Med. Research, 3 (1915), No. 2, pp. 371–394, pls. 6*).—An anatomical study which includes descriptions and drawings of the genitalia of most of the oriental species of Anopheles and of such others as were available. The author considers the genitalia to be the most satisfactory means for classifying the group.

Dasyneura ulmea, a new elm pest, J. S. Houser (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 82–84, fig. 1*).—The author reports that this itonidid is the source of injury to elms in Ohio. Its attack results in the formation of from 1 to 20 aborted bud galls, usually at the twig tips, which cause a check in the branch development and an ultimate stunting and malformation of the tree.

A new Phanurus from the United States, with notes on allied species, A. A. Girault (*Canad. Ent., 48 (1916), No. 5, pp. 149, 150*).—*Phanurus emersoni* **n. sp., reared from tabanid eggs at Dallas, Tex., and three allied species are described.**

Studies in flies.—Chætotaxy and pilotaxy of Muscidæ and range of their variability in the same species, P. R. Awati (*Indian Jour. Med. Research, 3 (1915), No. 1, pp. 135–148, pls. 3, figs. 6*).—The author's conclusions in regard to the importance of chætotaxy in Musca are as follows:

"It is very unreliable and hence of little use in classification. The number of bristles on the head is very variable in the same species; their arrangement, however, in some cases seems to be specific, as in the case of the facial bristles. The thoracic bristles show generic variations and hence are important in distinguishing Musca from other genera of the same family."

New genera and species of Australian Muscoidea, C. H. T. Townsend (*Canad. Ent., 48 (1916), No. 5, pp. 151–160*).

The development and auto-destruction of house flies in horse manure, E. Roubaud (*Compt. Rend. Acad. Sci. [Paris], 161 (1915), No. 11, pp. 325–327*).—The author reports investigations carried on at the central laboratory of the army.

He first calls attention to the fact that horse dung is the best medium for the development of house flies, it being estimated that the dung from a single animal is sufficient for the development in summer of from 40,000 to 50,000 per month, or from 160,000 to 200,000 from June to September. It appears that after scarcely 24 hours fermentation definitely protects the dung against oviposition therein. The use of certain antiseptics and larvicides, such as borax, solutions of cresyl, and ferric and ferrous sulphates, retards fermentation, thus prolonging the period in which oviposition may take place from one to two days, and in this way multiply the chances of infestation of the dung. By the end of the sixth day manure placed in heaps had apparently been vacated by the larvæ, which had migrated for pupation.

Larvæ of the house fly placed in manure at a temperature of 50° C. (112° F.) exposed to the gas formed by fermentation die in three minutes. In direct contact with the gas at a temperature of 51° death takes place in one minute, at 59° in from five to seven seconds, and at 60° in from four to five seconds.

Soluble poisons in the poisoned bait spray to control the adult of the apple maggot (Rhagoletis pomonella), H. H. P. Severin (*Maine Sta. Bul. 251 (1916), pp. 149–168, fig. 1*).—Experiments conducted during 1914 and 1915 are reported.

No conclusions can be drawn on the effectiveness of the poisoned bait spray from any of the experiments performed during 1914 due to the fact that the different soluble poisons scorched the leaves and therefore insoluble arsenicals were then substituted. A series of experiments with different amounts of soluble poisons, such as potassium and sodium arsenate and sodium arsenite, show that as small a quantity as 0.25 oz. of these insecticides dissolved in boiling water and then added to 3 gal. of water with one pint of molasses will burn the foliage of the apple trees.

"In 1915, during a very rainy season, the results obtained with three applications of the poisoned bait spray containing a soluble poison dissolved in diluted molasses [potassium arsenate 0.75 oz., molasses 1 pint, and water 3 gals.], showed that the infestation varied from 0 to 20 per cent in orchards situated away from the margin of the experimental area, and from 32 to 57 per cent in orchards near untreated trees. An even distribution of the droplets over the foliage is more effective than spraying the trunk, large limbs, and foliage of the lower branches. The number of applications necessary to insure good results can not be stated with this work still in its experimental stage. In orchards where tent caterpillars have practically stripped or partially defoliated the trees the poisoned bait with the use of a soluble poison can not be advocated.

In orchards where tent caterpillars are controlled, defoliation caused by spray injury is far less than the damage caused by these pests in neglected orchards. Our experience shows that after fruit growers have been convinced of the results obtained by the use of the poisoned bait spray, many prefer sound fruit even if burned foliage is the necessary price.

"The fruit fly remedy has been a complete failure in the control of the pest under town conditions. With four applications of the spray the infestation varied from 4 to 98 per cent."

Dangerous hard backs, H. A. BALLOU (*Agr. News* [*Barbados*], *15* (*1916*), *No. 359, pp. 42, 43, figs. 5*).—An account of the more important lamellicorn grubs occurring in the West Indies.

Second report on insecticides for the control of the Colorado potato beetle (Leptinotarsa decemlineata), L. B. SMITH (*Virginia Truck Sta. Bul. 17* (*1915*), *pp. 369–376*).—This paper gives the results of the second season's experiments in the control of the Colorado potato beetle. These results are said to confirm the more important points of the work done the previous season (E. S. R., 33, p. 358).

The mixture of homemade Bordeaux 50 gal., arsenate of lead 4 lbs., and Paris green 1 lb., continued to give excellent results. Arsenite of zinc paste at the rate of 2 lbs. to 50 gal. of Bordeaux also proved very efficient. Calcium arsenate was tried this year and the results indicate that it may prove valuable for the purpose. Several of the proprietary insecticides that were used gave returns that compared favorably with the home-prepared mixtures in efficiency. The price of arsenic oxid varied according to the form in which it was obtained, costing 24⅘ cts. per pound in the calcium arsenate powder and 51⅗ cts. in powdered lead arsenate.

Sulphur-arsenical dusts against the strawberry weevil (Anthonomus signatus), T. J. HEADLEE (*Jour. Econ. Ent.*, *9* (*1916*), *No. 1, pp. 84–89, fig. 1*).—Substantially noted from another source (E. S. R., 35, p. 364).

Life history of the pecan twig girdler, S. W. BILSING (*Jour. Econ. Ent.*, *9* (*1916*), *No. 1, pp. 110–115*).—The eggs of *Oncideres texana* hatch in from 17 to 30 days after deposition. The larvæ then burrow in the girdled twigs until the following summer, or for a period of from 288 to 328 days. Pupation takes place during the latter part of August and the first part of September, the pupal stage which lasts from 12 to 14 days being passed in the larval burrow.

It was found that where forests are located near a pecan orchard and it is impractical because of migration from other trees in pecan trees, to gather up the fallen twigs and burn them in order to kill the larvæ, they may be effectually dealt with through the use of arsenate of lead.

The German genera and species of the ichneumonid tribe Anomalini, O. SCHMIEDEKNECHT (*Naturw. Ztschr. Forst u. Landw.*, *14* (*1916*), *No. 3–4, pp. 97–116, figs. 4*).—A synopsis of the forms of this important tribe (parasites of Lepidoptera) which occur in Germany.

Note on an interesting case of two generations of a parasite reared from the same individual host, P. H. TIMBERLAKE (*Canad. Ent.*, *48* (*1916*), *No. 3, pp. 89–91*).—The author records the rearing of two generations of the braconid parasite *Dinocampus americanus* from the convergent lady beetle (*Hippodamia convergens*). This shows that this parasite does not injure the vital organs of its host.

The European Trichogramminæ, with particular consideration of their practical importance as parasites, M. WOLFF (*Ztschr. Forst u. Jagdw.*, *47* (*1915*), *Nos. 8, pp. 474–497; 9, pp. 543–568, figs. 24*).—A synopsis of the European forms of this important subfamily of parasites.

A preliminary report on the life economy of Solenopsis molesta, J. W. McColloch and W. P. Hayes (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 23–38, pl. 1, fig. 1*).—A report of biological and economic studies of the Kafir ant (*S. molesta*), which in Kansas destroys the seed of Kafir corn, cane, milo maize, and feterita. The most practical control measures in southern Kansas consist in fall plowing and thorough spring harrowing, as well as surface and early planting of the crop.

Spraying versus beekeeping, B. N. Gates (*Mass. Bd. Agr., Apiary Insp. Bul. 10A (1916), pp. 22, pls. 2*).—This paper reviews the literature and reports instances of losses of bees occasioned by their working upon fruit trees, etc., that were sprayed while in bloom.

Fifth and sixth annual reports of the state inspector of apiaries for the years 1914 and 1915, B. N. Gates (*Agr. of Mass., 62 (1914), pp. 407–415, pl. 1; 63 (1915), pp. 111–138, pls. 3; Mass. Bd. Agr., Apiary Insp. Buls. 9 (1915), pp. 11, pl. 1; 10 (1916), pp. 30, pls. 3*).—The most recent of these reports, which are along the lines of previous years (E. S. R., 32, p. 556), includes an appendix giving the paper above noted on Spraying *v.* Beekeeping.

Is the hive a center for distributing fire blight? Is aphid honeydew a medium for spreading blight? H. A. Gossard (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 59–64, pls. 2*).—The tests here reported "prove conclusively to us that the blight organism, in honey, can remain sufficiently virulent for 47 hours to produce infection, with the extreme time measure of virulency probably not reached. Tests of this kind were made with fresh apple honey and also with well-ripened honey taken from the hive in midsummer and the results were substantially the same. It is evident from these results that the formic acid of honey is not immediately fatal to the blight organism. . . . We believe we have proved that if one bee carries 100,000 bacilli into the hive one day, that on the following one or two days, each of 1,000 bees has the possibility of carrying a considerable fraction of 100 virulent bacilli out to fruit blossoms, because practically all the bees in the hive are at work during the night curing the honey. This would seem to go a long way toward explaining the wholesale infection that occurs in the latter part of the blooming period."

The Pajaroello tick (Ornithodorus coriaceus), W. B. Herms (*Jour. Parasitology, 2 (1916), No. 3, pp. 137–142, fig. 1*).—Notes are given on the life history and biting habits of this tick, based largely upon observations in California by the author and W. L. Chandler.

This tick has been found to occur in a number of counties of the State, including San Benito, Santa Clara, Stanislaus, Monterey, and Santa Barbara, and probably also Los Angeles and San Diego, thus connecting up with Mexico, which is the original habitat. It is most commonly found among dry leaves beneath live-oak trees, where cattle are accustomed to lie in the shade.

Eggs deposited March 9 hatched March 31, giving an incubation period of 21 days, at an average temperature of 26.3° C. A larva placed on the ear of a rabbit May 2 was recovered fully engorged May 11, and molted 10 days later, on May 21. The second molt, without a second engorgement, took place June 15. The nymph became fully engorged in about 20 minutes, on July 2; the third molt occurring August 12. It again engorged October 11, the fourth molt taking place December 23. After another engorgement on January 16, the fifth molt took place on March 9 and the tick appeared as a sexually mature female. On March 27 the female became fully engorged, copulation took place on April 17, and on June 10 428 eggs were deposited.

The number of molts varied from four to seven. The maximum number of eggs deposited by a tick in one season was 1,158, there being seven separate layings.

Both nymphs and adults readily attached to man, monkey, rabbit, and mouse, and became fully engorged in from 15 to 30 minutes. A sharp pain is felt at the time the bite of the tick takes place and the point of attachment remains highly irritated for several days, during which time a scab forms. An extensive swelling of the affected part may follow its bite.

FOODS—HUMAN NUTRITION.

Skim milk in human and animal nutrition, L. MALPEAUX (*Vie Agr. et Rurale, 6 (1916), No. 23, pp. 401–407, fig. 1*).—Data are given regarding the nutritive value of skim milk and its use as food for man, calves, and pigs.

The soy bean as a food material, W. SCHIEDER (*Seifensieder Ztg., 42 (1915), No. 22, pp. 471, 472*).—Descriptions and analyses are given of a number of different products prepared from the fermented and the unfermented soy bean.

Chemical composition of the fruit of the cheromayer, A. CUTOLO (*Staz. Sper. Agr. Ital., 48 (1915), No. 12, pp. 889–898*).—Data are reported regarding the chemical composition of the pulp, skin, and seeds of this fruit, which somewhat resembles the pear.

Maté tea, O. RAMMSTEDT (*Pharm. Zentralhalle, 56 (1915), Nos. 4, pp. 29–34; 47, pp. 708–710*).—Analytical data are given regarding a number of commercial samples of maté, which is obtained from the Brazilian herb *Erica vulgaris*. The active principle of maté is mattein, a substance identical with or closely related to caffein. The composition of maté is also compared with that of tea and coffee.

[Analyses of] extracts and spirits (*Maine Sta. Off. Insp. 77 (1916), pp. 21–40*).—This publication reports the results of the analysis of a number of samples of extracts of peppermint, wintergreen, vanilla, lemon, etc., together with a statement regarding them by A. M. G. Soule.

[Food and drug inspection and analysis], C. L. CLAY (*Bien. Rpt. La. Bd. Health, 1914–15, pp. 63–105, figs. 2*).—Analytical data are reported regarding 2,017 samples of water, miscellaneous foods, drugs, and patent medicines. The results of the inspection of dairies are also given.

[Food inspection], A. W. J. MACFADDEN (*Ann. Rpt. Local Govt. Bd. [Gt. Brit.], 44 (1914–15), pp. 18–20*).—This is a review of the work of the food inspectors during the year 1914–15. In addition to the routine work it included the inspection of food for the troops, a continuation of the studies of infant foods (E. S. R., 32, p. 661), the inspection of food for exports, and the investigation of several outbreaks of food poisoning.

Food and oil laws of the State of Wyoming (*Cheyenne, Wyo.: Office Dairy, Food, and Oil Comr., 1915, pp. 82*).—The text of the laws is given, together with rules and regulations adopted by the food commissioner, and the standards of purity for food products.

Hints on inspecting canned foods, W. D. BIGELOW (*Chem. Engin. and Manfr., 24 (1916), No. 3, pp. 108–110*).—Among the factors stated to be of importance in the inspection of canned goods are a knowledge of the raw product and the methods and conditions of manufacture; the external appearance of the can; the odor, flavor, and appearance of the contents of the can on being opened; and the bacteriological examination.

A proposed score card for refrigerators, W. A. EVANS (*Amer. Jour. Pub. Health, 6 (1916), No. 7, p. 743*).—A score card is described which can be used by health departments, food departments, manufacturers, merchants, or housewives. The apparatus required consists of ice scales, a thermometer, a tape line, and a hygrometer. The factors considered are the temperature of the food

chamber, ice economy, humidity, circulation of air, interior finish, drainage, and exterior finish.

The bacillus carrier and the restaurant, A. I. KENDALL (*Amer. Jour. Pub. Health, 6 (1916), No. 7, pp. 726–729*).—This article considers the danger of the contamination of food by the bacillus carrier, and describes the measures taken to prevent such contamination in the restaurant of a department store when it was possible that some of the cooks and waitresses had been exposed to typhoid infection. The measures taken included thorough scrubbing of the hands before starting work and after any absence from the restaurant during the day; the application of the Widal test; and the examination of the urine and the feces.

[**Care of the baby**], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul., 4 (1916), No. 5, pp. 97–132, figs. 8*).—This contains information on the care and feeding of children.

The diet of children after infancy, J. H. M. KNOX (*Jour. Amer. Med. Assoc., 67 (1916), No. 6, pp. 432–435*).—This paper calls attention to such data as are available regarding the food requirements of young and growing children, and gives diet lists suitable for a child from 12 to 18 months and a child from 2 to 4 years of age. The author emphasizes the importance of giving more consideration to the diet of young children.

The new emergency ration [of the U. S. Army] (*War Dept. [U. S.] Ann. Rpts., 1915, I, pp. 271, 272*).—A brief progress report of the work on the emergency ration conducted by the Office of Home Economics of the U. S. Department of Agriculture.

Report by the departmental committee appointed to inquire into the question of maintaining and if possible increasing the present production of food in Scotland, E. WASON ET AL. (*Edinburgh: Govt., 1915, pp. 16*).—A number of recommendations are formulated.

Minutes of evidence taken before the departmental committee appointed to inquire into the question of maintaining and if possible increasing the present production of food in Scotland (*Edinburgh: Govt., 1915, pp. 166*).—This publication contains the minutes of the hearings and other evidence upon which the above report was based.

The normal gastric secretion, M. E. REHFUSS (*Proc. Amer. Phil. Soc., 55 (1916), No. 6, pp. 461–470*).—In this article the author brings together a great deal of information regarding the normal secretion of the gastric juice which has been obtained in a number of experiments by himself and other investigators, notably Hawk, Bergeim, Fowler, Spencer, Clarke, and others. The bulk of the material has been noted from other sources.

The uric acid solvent power of normal urine, H. D HASKINS (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 205–215*).—The experimental data here reported may be summarized briefly as follows:

"When shaken with uric acid for 20 minutes at 37° C. many urines that are slightly acid and all that are neutral or alkaline take up extra uric acid. The less acid the urine the more uric acid, as a rule, it will dissolve. Dilute urines when considered in proportion to their concentration show much greater solvent power than less dilute urines.

"Some urines dissolve so much uric acid that they come to contain more uric acid than is present in a saturated solution of monosodium urate. In all probability in these cases at least part of the uric acid is in colloidal solution."

Creatin in human muscle, W. DENIS (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 379–386*).—Employing the method of Folin, the author studied the creatin content of samples of muscle obtained at the autopsies of 5 normal individuals and 72 individuals dying from various diseases. Determinations were also made of the creatin in muscles obtained from several autopsies of children.

From the results reported it appears that "the fact that the muscle of children contains much less creatin than that of adults was confirmed." These results apparently confirm the theory concerning the relationship of muscle creatin and urinary creatinin in man offered by other investigators, who have called attention to the low creatinin coefficients in the case of persons in a feeble and wasted condition; as such individuals become convalescent and show an increase in the "muscle tonus" a rise in the creatinin coefficient is noted.

The creatinin and creatin content of the blood of children, B. S. VEEDER and M. R. JOHNSTON (*Amer. Jour. Diseases Children, 12 (1916), No. 2, pp. 136–144*).—This paper reports experimental data regarding the content of creatin, creatinin, and nonprotein nitrogen in the blood of children under normal and clinical conditions. The data are based upon experiments made with 75 children.

Experimental studies on creatin and creatinin.—V, Protein feeding and creatin elimination in pancreatic diabetes, W. C. ROSE (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 331–338*).—The author reports experiments in continuation of earlier work on the influence of diet on the elimination of creatin and creatinin (E. S. R., 26, p. 158).

Experiments with laboratory animals (dogs) showed that protein feeding in the animals after complete extirpation of the pancreas did not lead to the disappearance of creatin from the urine, as was the case with similar feeding in normal fasting animals. In the opinion of the author the behavior of the creatin elimination in phlorizin and pancreatic diabetes offers proof of the dependence of the creatin elimination upon the carbohydrate utilization.

Experimental studies on creatin and creatinin.—VI, Protein feeding and creatin elimination in fasting man, W. C. ROSE, F. W. DIMMITT, and P. N. CHEATHAM (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 339–344*).—The results are reported of observations upon two normal, healthy young men receiving a diet of eggs after a period of fasting. The following conclusions are drawn:

"Contrary to the generally accepted idea, protein feeding in starving man promptly reduces the creatin output to nil.

"The amount of acetone bodies present in the urine during short fasts (three to four days) is not sufficient to render the creatin-creatinin figures unreliable. Four times the quantities of acetone and diacetic acid eliminated in the present experiments were entirely without effect upon the creatinin readings."

Experimental studies on creatin and creatinin.—VII, The fate of creatin and creatinin when administered to man, W. C. ROSE and F. W. DIMMITT (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 345–353*).—Excessively large doses of creatin and creatinin were fed to individuals in nitrogen balance and the effect observed on urinary composition, particularly with reference to the output of urea. The following conclusions are drawn:

"The ingestion of large doses (20 gm.) of creatin in man leads to a very perceptible increase (0.30 to 0.49 gm.) in the output of creatinin. This increase in urinary creatinin is attributed to a conversion of creatin into its anhydrid, and not to an increase in the output of endogenous creatinin.

"The ingestion of large doses (16 gm.) of creatinin is not followed by the appearance of creatin in the urine. This indicates that the reaction Creatin$\rightarrow$ Creatinin$+$Water is probably not a reversible one in the human organism.

"No evidence was obtained indicating a transformation of creatin or creatinin into urea by the body cells. On the contrary, urea is probably not a catabolic product of these substances."

The physiological action of glucal, J. O. BALCAR (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 163–171*).—This investigation was made in view of the fact

that glucal is so closely related to glucose and may possibly be an intermediate stage of glucose metabolism. In addition to studying the chemical characteristics of glucal, experiments were carried out with various laboratory animals which showed that glucal is not toxic, produces no effect on blood pressure or on respiration when injected intravenously in moderate quantities, and is not completely metabolized by the animal body when injected at the rate of 0.9 gm. per kilogram of body weight per hour.

The lipoids ("fat") of the blood in diabetes, W. R. Bloor, E. P. Joslin, and A. A. Hornor (*Jour. Biol. Chem., 26 (1916), No. 2, pp. 417–430*).—The observations here reported show in part that "in severe diabetes the blood lipoids were all markedly increased, up to 100 per cent or more of the normal values. In mild diabetes the lipoids may be normal. In general, the more severe or long standing the diabetic condition, the more marked was the abnormality in the blood lipoids.

"In spite of the high values, the relations between the lipoids were practically those of normal individuals, indicating that the fat metabolism was essentially normal."

For earlier work, see previous notes (E. S. R., 34, pp. 562, 563).

Pellagra—a critical study, J. Aulde (*Med. Rec.* [*N. Y.*], *90* (*1916*), *No. 5, pp. 181–185*).—The author advances the theory that the essential factor in the production of pellagra, scurvy, and beri-beri is the mineral deficiency in the protein molecule, and that calcium depreciation is responsible for pellagra.

Preliminary observations on metabolism in pellagra, A. Hunter, M. H. Givens, and R. C. Lewis (*Pub. Health Serv. U. S. Hyg. Lab. Bul. 102* (*1916*), *pp. 39–67*).—Data are given regarding the amount of indican excreted and the nitrogen balances in the case of a number of inmates of the pellagra hospital at Spartanburg, South Carolina.

Pellagra.—The value of the dietary treatment of the disease, J. R. Ridlon (*Pub. Health Rpts.* [*U. S.*], *31* (*1916*), *No. 30, pp. 1979–1999*).—This report is based on observations upon 58 pellagra patients in the U. S. Marine Hospital at Savannah, Ga. The patients were given a diet relatively rich in animal and leguminous protein component and relatively poor in nonleguminous-vegetable component. It is concluded from these cases that the dietectic treatment of pellagra is of paramount importance, and "that in this series success has followed the use of a diet in which the animal and leguminous-protein component has been relatively increased and the nonleguminous-vegetable component relatively decreased."

As a part of the histories of the pellagra patients an attempt was made to ascertain the diet consumed during the three months previous to the appearance of the disease. The data collected from 35 patients are reported in this article. "A study of these diet histories shows that the vegetable and fat components were notably conspicuous and that the animal protein foods were relatively inconspicuous."

The energy metabolism of a cretin, F. B. Talbot (*Amer. Jour. Diseases Children, 12* (*1916*), *No. 2, pp. 145–148, fig. 1*).—The heat production of a cretin, 3 years 8 months old, was determined by the calorimeter to be 898 calories per square meter of body surface, or 40.5 calories per kilogram body weight.

ANIMAL PRODUCTION.

Meat situation in the United States, I–IV (*U. S. Dept. Agr. Rpts. 109* (*1916*), *pp. 307, pl. 1, figs. 31; 110* (*1916*), *pp. 100, pls. 6; 111* (*1916*), *pp. 64, pls. 5, figs. 2; 112* (*1916*), *pp. 27*).—This portion of the report is treated in four parts.

I. *Statistics of live stock, meat production and consumption, prices, and international trade for many countries*, G. K. Holmes.—This treats of the number of meat animals in the United States and other countries, meat exports and imports, production and consumption, losses of meat animals, prices, meat-producing conditions in other countries, and conditions and problems in the United States. Under this last heading are treated local origin of cattle for slaughter and feeding, age of beef cattle, yearly marketings of meat animals, yearly slaughterings at principal places, increase of retail over wholesale price, and 1-year tenancies.

II. *Live-stock production in the eleven far western range States. Based on reports from stockmen and county correspondents*, W. C. Barnes and J. T. Jardine.—The data contained in this report are based upon studies made in the summer of 1914 of conditions in Arizon, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The studies show that in these 11 States there was an estimated reduction of 859,120 cattle and 4,537,578 sheep in 1914, as compared with 1910. Considering four sheep as the equivalent of one cow, this means a reduction of approximately 13 per cent in live stock (cattle and sheep). The entry and settlement of approximately 85,500,000 acres of lands in these States since 1909 has resulted in a decrease of approximately 16 per cent in live-stock production since 1910 due to the breaking up of ranges formerly used as breeding grounds for cattle and sheep. High prices and general farm development in the range region have resulted in increased winter feeding of range live stock, thereby reducing the amount of range necessary per animal, and consequently in part offsetting the decrease due to settlement. "Uncertainty as to future conditions, difficulty of securing money for purchase of breeding stock, increase in value of land and dairy products, improvement in grade and weight of animals at the expense of numbers, drought and severe winters, and range deterioration have had some effect in bringing about decreases in numbers during a part of the period 1910–1914, but, considering this period as a whole, these factors had only a small influence in the aggregate."

As regards the possibilities of increased production in the future the investigations indicate that there will probably be an increase of 15 per cent in the next ten years, from 1915 to 1924, inclusive, because settlers on approximately 100,000,000 acres of range lands settled since 1905 will turn to raising live stock; the carrying capacity of summer range within National Forests will increase probably 15 per cent, and winter feeding adjacent to National Forest ranges will probably increase accordingly; and better management of stock, both on farms and on the range, will result in greater economy in the use of forage and, consequently, will increase the number of stock produced with a given amount of forage.

From a study of the cost of production, it is concluded that for sections of the West where winter feeding is practiced the man who contemplates substituting live stock for other forms of agriculture should figure on a cost of approximately $30 for the production of a good yearling, and $45 for the production of a good long 2-year-old; this cost to include labor, market value of feeds, taxes, loss, bull service, and any depreciation of breeding stock. In sections of these same States where only a part of the stock is fed in winter the cost of producing a yearling may be set at approximately $25, and of a 2-year-old at $35. In the range sections of the Southwest the cost of producing a yearling may be set at from $15 to $19, varying greatly with the number of calves per 100 cows, and the cost of producing a long 2-year-old at approximately from $20 to $25. The average weight given for a 2-year-old steer in the feeding sections is 960 lbs. At $45 as the cost of production, the cost per pound is about

4.6 cts. For Arizona and New Mexico the average weight of a 2-year-old steer is given as 775 lbs. At $25 for production the cost per pound is a little over 3.2 cts. For the Southwest, hazard due to the exceptional loss in time of prolonged drought is not fully covered in the above costs.

On the basis of the report of the U. S. Tariff Board of 1911 together with modifications to bring the figures down to 1914, it is estimated that the cost of producing a lamb in California is $1.55, in Arizona, Colorado, and New Mexico, $1.71, and in Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming, $1.82. These figures cover loss and depreciation, provide for interest on capital invested in land, improvements, and equipment, and include wool at market price.

A brief discussion is given of conditions in each State included in the investigations.

III. *Methods and cost of growing beef cattle in the corn-belt States*, J. S. Cotton, M. O. Cooper, W. F. Ward, and S. H. Ray.—The object of this study was to determine as accurately as possible the cost of producing beef animals on corn-belt farms. In order to get significant figures, 596 records were obtained from farms chosen at random in the States of Indiana, Illinois, Minnesota, Iowa, Missouri, South Dakota, Nebraska, and Kansas. An effort was made to get at least 20 records in a locality. The farms visited in the various States ranged in size from an average of 294 acres in Indiana and Illinois to 566 in Kansas. The value per acre ranged from $59 in Indiana to $175 in Iowa. Records were procured on 14,634 cows and 621 bulls, and on 12,591 calves produced from them, of which 2,023 were fattened for baby beef.

The records were arranged in six groups, classified as (1) beef (farms where all the cows are kept strictly for beef, but not including farms producing baby beef; (2) baby beef (farms on which the breeding herds are maintained for the production of high-grade calves which are fattened on the same farm and sold at from 12 to 18 months of age); (3) dual purpose (farms on which all of the cows are milked, and either cream or butter sold, the calves being weaned at birth and raised on skim milk); (4) mixed (farms on which the practice is to milk the best cows, their calves being weaned at birth and fed skim milk, the calves from the other cows being allowed to run with their dams as in the beef group); (5) partially milked (farms on which the calves are not weaned, but on which a part of the milk is drawn from the cow, the calf taking the remainder); and (6) double nursing (farms where some of the cows are milked and their calves given to other cows, the latter raising two calves each). The results are considered representative of the present-day operations of the corn-belt stock farm. The following table shows for the six groups the various factors that make up the cost of producing a yearling:

Summary of the various factors that make up the cost of producing a yearling.

Item.	Beef.	Baby beef.[a]	Dual purpose.	Mixed.	Partially milked.	Double nursing.
Number of farms	230	66	110	102	65	22
Average number of cows per farm	31.50	34.56	12.75	23.47	14.29	17.32
Cost of maintaining the breeding herd:						
Gross cost of maintaining a cow	$35.12	$36.77	$55.14	$43.95	$42.75	$46.50
Credits other than calf	$4.79	$5.39	$49.07	$24.72	$21.43	$33.26
Net cost of maintaining a cow	$30.33	$31.38	$6.07	$19.23	$21.32	$13.24
Net cost of maintaining a bull	$42.27	$53.26	$37.51	$46.79	$34.14	$40.53
Calf crop:						
Percentage of cows raising calves to weaning time	84.90	90.70	83.90	87.50	90.10	92.10
Number of calves per bull	20.90	25.30	10.70	18.50	12.60	15.00

[a] The statement for the baby-beef group gives figures on the calves until they are marketed at approximately 15 months of age.

Summary of the various factors that make up the cost of producing a yearling—Continued.

Item.	Beef.	Baby beef.	Dual purpose.	Mixed.	Partially milked.	Double nursing.
Cost of raising a calf to weaning time:						
Cow charge	$35.47	$34.50	$7.34	$22.29	$23.71	$14.53
Bull charge	$2.26	$2.29	$4.12	$2.91	$3.35	$3.02
Feed	$0.01	....	$9.55	$4.48	[illegible]	$0.26
Labor	....	....	$2.56	[illegible]	....	$0.01
Total cost at weaning time	$37.74	$36.79	$23.27	$31.79	[illegible]	$17.82
Cost of raising a yearling:						
Number of farms	190	47	99	96	57	22
Average number of calves per farm	24.43	30.20	10.57	15.44	11.16	41.23
Cost at weaning time	[a] $38.20	[a] [b] *[illegible]*	[a] $23.54	[a] $31.62	[a] $24.39	$17.82
Winter-feed cost	$12.32	*[illegible]*	[illegible]	[illegible]	$12.21	$11.24
Other charges	$4.62	*[illegible]*	$4.92	$4.72	$4.66	$3.86
Gross cost	$55.14	*[illegible]*	$38.49	[illegible]	[illegible]	$31.92
Credits	$1.60	*[illegible]*	$1.89	$1.48	$1.54	$1.67
Net cost	$53.54	$70.52	$36.60	$45.96	$41.72	$30.25

[a] A change in the number of farms on which the tabulation of the cost of producing yearlings is based causes the figures on cost of calf at weaning time to change in this part of the table.

[b] Italic figures here call attention to the fact that the baby-beef animal is carried somewhat beyond the yearling stage.

"The data obtained indicate that the keeping of cattle for beef purposes alone is adapted to the more extensive types of farming, while the keeping of cattle primarily for beef purposes, but where an income is also obtained from milk products, is better adapted to the more intensive types of farming.

"The averages brought out in this investigation would seem to indicate that profits obtained from the raising of calves on corn-belt farms are very small. However, the following facts must be taken into consideration: (1) Good returns have been obtained for a large quantity of roughage which, had it not been utilized by live stock, would have been waste; (2) a home market has been provided for salable crops; (3) on many farms a large acreage suitable to pasture only has been utilized; (4) profitable employment is provided for a season of the year when labor otherwise might be idle; (5) a return is obtained for capital invested in equipment which, in many instances, were it not utilized by live stock, would return nothing; and (6) when the farmer merely breaks even he has at least made 6 per cent interest on the money he has invested in the cattle business. When all of these factors are taken into consideration, even though there appears to be little or no profit, it is believed that in most cases the farm income is greater because of cattle having been kept on the farm."

IV. *Utilization and efficiency of available American feedstuffs*, W. F. Ward and S. H. Ray.—In this study the total loss to farmers from the waste of corn fodder and straw is estimated at about $102,860,000 each year.

In 1914 about 120,000,000 tons of straw was produced in the United States. Of this, 55 per cent was fed to live stock, while 15 per cent was burned, 8 per cent sold, and 22 per cent plowed under or otherwise disposed of. It is suggested that greater publicity concerning the value of straw, its use as a filler in commercial feeds, and in various manufactures, might aid somewhat in preventing its waste.

Corn stover produced in the United States is estimated at 245,258,000 tons, of which 81.5 per cent was fed to cattle and other stock. No data were obtained as to the percentage wasted in feeding, but is estimated as at least 35 per cent. This waste can be checked through the use of better methods for feeding fodder and stover, and it can be almost entirely stopped through the use of silos. Of the total amount of stover produced 3.7 per cent was burned, 10.2

per cent plowed under, and the rest sold or disposed of in other ways. Emphasis is put on the advantage of using as large an amount as possible of these materials for silage, only 8.1 per cent of the corn acreage now being used in this way.

To feed the large quantities of straw and stover now wasted would necessitate the feeding of large quantities of concentrated feeds which are now disposed of in a less economical manner. For instance, more than 810,000 tons of cotton-seed meal was used in six southern States in 1914 for fertilizer. If this had been fed to live stock and the manure used for fertilizer the value of the meal would have been increased from 50 to 85 per cent. This is true of all the oil meals used for both fertilizer and feeding purposes. The food value of these concentrated protein materials can be further increased through the more extensive use of silage.

A nation-wide campaign to teach the value and use of food-unit values for all the more common feeding stuffs is advocated.

More experimental study of spineless cactus as a feeding stuff is suggested. Common sugar cane and Japanese sugar cane are regarded as very promising forage crops for the extreme South, while the utilization of the by-products of sugar cane, such as cane tops, bagasse, and blackstrap molasses, may afford large savings in the cane-growing section. Feterita and Sudan grass are deemed promising for the semiarid West, Sudan grass as an important hay crop in other sections of the country, and teosinte in the extreme South.

Silage crops are deemed more economical than roots and serve almost the same purpose. The animal by-products, such as tankage, fish meal, etc., are excellent feeds for hogs, but are little used for cattle. Dried brewers' grains and distillers' by-products are in general use and are generally fed with care. Improvements could probably be made in the method of feeding the slop by the use of other concentrated feeds and some dry roughage. Canning factory refuse could be increased in value by storing in silos rather than in huge piles in the open. Beet pulp is usually handled in an economical manner and comparatively little of it is wasted.

Investigation in animal nutrition: Beef production, T. L. Haecker (*Minnesota Sta. Bul. 155 (1916), pp. 3–31*).—During the winter of 1907–8 a series of experiments was inaugurated with beef-bred calves to determine their composition by making a complete chemical analysis of a fairly representative one at each period of 100 lbs. gain in weight, and also to keep a complete record of all food consumed by each animal and the dry matter and digestible nutrients required for production to the various stages of growth. The records of five groups are given and commented upon.

The calves received from 8 to 10 lbs. of whole milk per day for two or three weeks, according to the judgment of the feeder, and then a gradual change was made to separator skim milk. The roughage fed was choice upland prairie hay and corn silage. The concentrates were farm grains and their standard by-products, such as bran, flour middlings, and oil meal. All the steers were kept in the barn during their lifetime, except that half the steers from three groups were turned to pasture when they were one year old. During the first year they were all kept in small portable stalls. During the second year those that were retained in the barn on continuous stall-feeding had the freedom of a runway in the barn and were confined in portable stanchions only while they were eating their rations. Each steer always received as much hay and silage as he would eat, and the amount of grain required was determined by the feeder. The following table presents data based on the average of all the

steers in the five groups, showing the growth during the various stages and the feed requirements found necessary to convert a calf into a 1,200-lb. steer, ready for market, in approximately two years:

Average weights and gains per steer, feed consumed and total cost of feed consumed per steer, and cost per pound of gain.

Period.	Weight.	Gain.	Milk.	Skim milk.	Grain.	Hay.	Silage.	Total cost of feed consumed.	Cost per pound of gain.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		*Cents.*
100	111.7		244	40				$3.28	10.6
100-200	199.2	87.5	216	879	95.6	106.6	6.9	6.58	7.5
200-300	299.6	100.1		577	198.1	236.7	132.3	4.94	4.9
300-400	401.6	102.0		163	256.0	297.7	332.3	5.11	5.0
400-500	502.5	100.9			301.9	333.8	476.8	5.56	5.5
500-600	601.5	99.0			286.8	319.4	417.1	5.24	5.3
From calf to 12 months		489.8	460	1,659	1,138.4	1,294.2	1,365.4	30.71	6.3
600-700	698.3	96.8			354.6	430.5	306.6	6.34	6.5
700-800	800.2	101.9			451.3	515.2	121.1	7.62	7.5
800-900	901.4	101.2			575.9	557.5	377.0	9.58	9.5
900-1,000	1,000.6	99.2			551.0	459.2	693.4	9.19	9.3
1,000-1,100	1,100.1	99.5			625.6	446.6	871.3	10.04	10.0
1,100-1,200	1,200.9	100.8			739.8	490.5	871.5	11.34	11.2
From 12 to 24 months		599.4			3,298.2	2,899.5	3,240.9	54.11	9.0
From calf to 24 months		1,089.2	460	1,659	4,436.6	4,193.7	4,606.3	84.82	7.8
1,200-1,300	1,302.5	101.6			834.5	786.0	1,064.4	14.62	14.4
1,300-1,400	1,400.6	98.1			853.3	770.0	1,176.0	14.91	15.2
1,400-1,500	1,500.0	99.4			905.8	560.0	1,736.0	15.37	15.4
From calf to 1,500 lbs		1,388.3	460	1,695	7,030.2	6,309.7	8,582.7	129.72	9.3

Data on two of the groups turned out to pasture as yearlings are given. Their weight as yearlings averaged 601.9 lbs. The steers were returned at the proper time, weighing an average of 707.6 lbs., and after a week's preliminary feeding were started on a feeding experiment. They were kept in an open runway, but twice a day were confined to stanchions while they were taking their morning and evening rations. The following table shows the average gains made and feed consumed:

Summary of pasture lots.

Period.	Average weight per steer.	Average gain per steer.	Grain consumed per steer.	Hay consumed per steer.	Silage consumed per steer.	Grain consumed daily per steer.	Average daily gain per steer.	Grain consumed per pound gain.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
700-800	801.8	94.2	234.8	175.0	718.2	6.40	2.648	2.40
800-900	904.5	102.7	324.7	207.0	1,106.0	7.10	2.276	3.18
900-1,000	997.6	93.1	423.3	254.4	1,395.1	8.10	1.780	4.56
1,000-1,100	1,092.8	95.2	513.8	340.7	1,282.6	9.20	1.699	5.41
1,100-1,200	1,204.4	111.6	582.7	254.5	1,309.7	10.40	1.994	5.22
Second year		496.8	2,079.3	1,231.6	5,811.6	8.23	1.998	4.12
First year		480.6	1,132.3	1,187.2	1,429.3	3.24	1.374	2.35

The average feed cost per steer for the first year was $30.48 and for the second year after returning from pasture, $35.84.

The difference in cost of production between the steers on continuous stall-feeding and those turned to pasture the second year affords data on the benefits

derived from pasture. The pastured steers of one group were in pasture 140 days and gained an average of 125 lbs. per head. During the time they were on stall feed the average cost was $61.70. They sold for 7.75 cts. per pound, while the lot on continuous stall-feeding cost $81.07 per head and sold for 8.25 cts. per pound. The pastured steers brought $23.16 net per head, and the stall-fed steers $9.38, so that the pasture saved 68.9 cts. per week on feed cost of production. The steers of the other group were in pasture 153 days and gained an average of 44.4 lbs. per head. The stall-fed steers brought an average of $19.36 net per head, and the pastured steers $26.26. Even under the small gain made they saved 31.4 cts. per week per head on feed cost of production.

[Animal husbandry] (*Nebraska Sta. Rpt. 1915, pp. X, XI, XV, XVI*).—In an experiment in pig feeding, carried on to determine the relative values of tankage and alfalfa hay in supplying protein to a ration in which ear corn and shelled corn were used, the results showed that the cheapest gains were made on a ration of ear corn and alfalfa hay. The addition of tankage to a ration of shelled corn and alfalfa increased the rate of gain and lowered the cost of gain when compared with shelled corn and alfalfa hay. However, this cost was higher than the cost of gains made with ear corn and alfalfa hay.

Seven lots of lambs were fed 90 days as follows: Lot 1, corn and oil meal on grass pasture; lot 3, corn, alfalfa hay, and silage; lot 4, corn, alfalfa hay, rape pasture, and turnips; and lot 6, corn and alfalfa hay in a dry lot; lots 2, 5, and 7 running in a cornfield and receiving in addition cotton-seed cake and alfalfa hay, alfalfa hay, and oil meal and alfalfa hay, respectively, after frost. The gains made varied from 0.18 to 0.27 lb. per day. The net profits for the lots 1 to 7 were $1.22 and 97, 91, 87, 68, 68, and 66 cts., respectively. In this experiment the lambs upon grass pasture with corn and oil meal made materially better gains than any other lot. The lot running in a cornfield receiving alfalfa hay after frost did not make as favorable gains as could normally be expected, owing to disturbances while the feeding experiment was in progress.

Experiments in pork production at the North Platte substation indicate that stewing or cooking alfalfa has increased the rate of gain slightly and slightly decreased the food eaten per pound of gain. However, the cost of stewing the alfalfa probably was greater than the advantages gained. The proportions of corn, tankage, and alfalfa hay eaten from self-feeders by fall shotes during the winter, where skim milk formed a part of the ration, were corn 85.1, alfalfa hay 8.1, and tankage 6.8. The food consumed per pound of gain was corn 2.915 lbs., alfalfa hay 0.278, tankage 0.235, and skim milk 2.58 lbs.

Three lots of lambs were fed during a winter as follows: Lot 1, corn and alfalfa; lot 2, corn, alfalfa, and cotton-seed cake; and lot 3, corn, corn silage, and alfalfa. The lot fed silage made a trifle larger gain, about 2.5 lbs. per head per week. The lambs fed cotton-seed cake gave a little more profit than those fed either of the other two rations, but probably not sufficiently greater to warrant the feeding of cotton-seed cake when the price is much above $30 per ton. Silage at $4 per ton was so expensive that the ration containing it produced less profit than either of the other two rations. The cost per pound of gain on a ration of corn and alfalfa hay was 5.7 cts.

Hogging down soy beans and cowpeas, E. S. Good and M. J. Smith (*Kentucky Sta. Bul. 201 (1916), pp. 139–149, figs. 2*).—Three lots of 90-lb. pigs were fed as follows: Lot 1, hogging down soy beans plus corn meal equal to 2 per cent of their body weight; lot 2, hogging down soy beans without corn; and lot 3, hogging down cowpeas and corn meal equal to 2 per cent of their body weight. The average daily gains made were 1.3, 0.261, and 0.303 lbs. per pig, and the cost per pound of gain, including cost of seed sown, plowing and cultivation, rent of land, labor involved in feeding, and corn consumed, was

4.54, 12.52, and 21.73 cts., for the respective lots. The total fertilizing value of the respective lots was estimated to be $17.68, $12.93, and $3.61.

The results indicate that it is not profitable to hog down soy beans (grain) unless a supplementary feed is given, for only 110 lbs. of pork were produced per acre with such a procedure, which did not pay for the seed sown, cost of cultivation, and rent of land.

It was found highly profitable to hog down soy beans when a supplementary feed, such as corn, was given, for the lot of hogs receiving 2 per cent of its weight in corn meal daily produced 825 lbs. of pork per acre at a cost of 4.54 cts. per pound gain. Valuing pork at 7 cts. per pound, the net value of pork produced by this acre of soy beans was $20.32, which, with $17.68 for the fertility left on this acre of ground, would make a total of $38. It was not found profitable to hog down cowpeas, even if supplemented with corn meal.

The acre of soy beans hogged off with a supplementary feed of corn produced feed for 10 hogs for 21 days and for 20 hogs for an additional 21 days. The acre of soy beans with no corn produced feed for 10 hogs for 21 days and for 15 hogs for an additional 14 days. The acre of cowpeas hogged off with a supplementary feed of corn meal given the hogs furnished feed for 15 hogs for 22 days.

Cooperative live-stock shipping associations in Minnesota, E. D. Durand (*Minnesota Sta. Bul. 156 (1916), pp. 5–29, figs. 3*).—This bulletin treats of the general character of the cooperative live-stock shipping-association movement, the number and location of such associations in Minnesota, and their distribution and volume of business, and gives suggestions for conducting the business and method of organization, including a suggested constitution and by-laws. The text of the Minnesota laws governing cooperative associations is appended.

Stallion enrollment.—V, The stallion enrollment law and the farmer, H. E. McCartney (*Indiana Sta. Circ. 52 (1916), pp. 16, fig. 1*).—An explanation of the Indiana stallion-enrollment law and the benefits of the law. It is shown that during the two years in which the law has been in operation there has been a decided increase in pure-bred stallions and jacks and a decrease in grades and scrubs.

Announcement regarding the egg-laying contest, J. J. Hooper and R. H. Wilkins (*Kentucky Sta. Circ. 12 (1916), pp. 27–39, figs. 5*).—This is an announcement of an egg-laying contest to be held at the Kentucky Experiment Station, beginning November 1, 1916, together with the rules and regulations governing the same.

DAIRY FARMING—DAIRYING.

[Dairying] (*Nebraska Sta. Rpt. 1915, pp. XI–XIII*).—Three years' experimental work to test the relative values of alfalfa hay and corn silage in milk production indicates that with the quality of silage and alfalfa hay which has been fed in these experiments, when corn silage is worth $3.50 per ton to produce milk, alfalfa hay is worth $8 per ton. This would indicate that where alfalfa hay is cheap and abundant the use of silage will not lessen the cost of milk production unless it can be produced at a lower cost than was charged for it in these experiments.

Corn silage has given more favorable results than alfalfa silage, due largely to the improper fermentation of alfalfa silage, which affected its palatability. Recent experiments have shown that a mixture of one-half green sorghum with one-half green alfalfa makes a good quality of silage, but the feeding value of this mixture has not been compared with corn silage.

A plan for a soiling crop on the basis of ten cows and adapted to Nebraska conditions is given. Experiments indicate that milk fat produced from soiling crops will be more expensive than where produced upon silage or pasture. Among the soiling crops used alfalfa produced milk and milk fat at the lowest cost.

The feeding of dairy cows, H. RABILD, H. P. DAVIS, and W. K. BRAINERD (*U. S. Dept. Agr., Farmers' Bul. 743 (1916), pp. 23*).—This discusses the factors involved in the economical selection of feeds and methods of feeding, including a discussion of various feeding stuffs and suggested rations.

Cost of milk and fat on pasture and in stable (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm., 41 (1915), p. 31*).—During the months of June, July, August, and September 32 cows were pastured and 15 cows were fed in the stable on rations identical with those used in the winter. The results were that group 1 produced milk at an average of 45.1 cts. per 100 lbs. and butter fat at 11 cts. per pound, and group 2, milk at 86 cts. per 100 lbs. and butter fat at 22 cts. per pound.

Fourth report on the cost of food in the production of milk in the counties of Kent and Surrey, G. H. GARRAD (*Southeast. Agr. Col. Wye, Rpt. Cost Food Prod. Milk 4 (1915), pp. 95*).—This is a continuation of work previously noted (E. S. R., 33, p. 276). Data on the cost of feed in the production of milk for the period from May 1, 1914, to May 1, 1915, and a brief summary of the results of the past three years' work are given.

It appears that the more milk a cow gives the cheaper becomes the cost of feed per gallon, and the most economical herds are those that yield well on a normal ration. There was a difference of about 5.5 cts. per gallon (nearly 12.5 cts. per day) between the cost of feeding in the six summer months (May 1 to October 31) and the six winter months (November 1 to April 30), the figures being 5.84 cts. per gallon in the summer and 11.32 cts. in the winter. The effect of a dry summer is felt not merely in increasing the cost of production of summer milk, but also in increasing the cost of the winter milk, because the natural result of a dry summer is a short crop, i. e., an expensive crop, of roots and fodder.

In every year the cost of feeding, per gallon, has been half as much again on the most expensive farm as on the cheapest farm. The 16 cheapest herds (7.08 cts. per gallon) cost 16.28 cts. per cow per day for feed and averaged 2.3 gal. of milk. The 16 most expensive herds (10.06 cts. per gallon) cost 21.82 cts. per cow per day and averaged 2.17 gal. of milk.

Cost of food in the production of milk, C. CROWTHER and A. G. RUSTON (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 88 (1913), pp. 32; 91 (1914), pp. 40; 98 (1915), pp. 37, pls. 2*).—In these reports data are given on the production of milk in ten herds under study, the value of the milk, the feed consumed, the cost of feeding, and the milk-fat percentage. See also a previous note (E. S. R., 29, p. 278).

Announcement of the California state dairy cow competition, 1916–1918, F. W. WOLL (*California Sta. Circ. 153 (1916), pp. 8*).—An announcement of and regulations governing a dairy-cow competition to be held at the College of Agriculture of the University of California are given.

The bacteria of milk freshly drawn from normal udders, ALICE C. EVANS (*Jour. Infect. Diseases, 18 (1916), No. 5, pp. 437–476*).—This study included 192 samples of milk from 161 cows of five different dairies in two widely distant sections of the country. No consideration was given to those types of bacteria which occurred in the udder in small numbers. All the cultures which were studied in detail and included in this report represent bacteria which were multiplying in the udder and were found in the milk in considerable numbers.

In 32 samples, bacteria were not multiplying in numbers worth considering. Three types of bacteria were found commonly present in milk from all five dairies; they were streptococci, staphylococci, and bacilli. The ordinary milk-souring organism, *Streptococcus lacticus*, was not found in any of the samples of milk. It does not appear to localize and multiply in the udder. Long-chained streptococci which failed to give the reduction of litmus in milk cultures characteristic for *S. lacticus* were isolated from 29 samples. The highest number found per cubic centimeter was 264,000. Micrococci were found in 113 samples, the highest number found per cubic centimeter being 80,000.

The majority of the micrococci were shown to belong to one group, which agrees in characteristics with the pyogenic staphylococci. The majority of cultures of this type were nonvirulent, but some cultures were virulent, and two cultures possessed such a high degree of virulence that inoculated rabbits died in about 16 hours. Three other types of micrococci from the udder gave reactions which differed from those of the pyogenic staphylococci sufficiently to separate them into distinct groups. One of these groups is described, but no name is suggested for it because of the small number of cultures studied. Another group was identified with *Micrococcus luteus*, according to Winslow's classification. The third group was characterized by the rapid and complete peptonization of milk, and the name *M. caseolyticus* is suggested for this group.

Peculiar strains of the types of bacteria commonly present in freshly drawn milk were sometimes found localized in the udders of several cows of one dairy. A few cases were found of peculiar species, unlike any of the other udder organisms, localized in this same way.

The bacilli commonly present in milk from all five dairies were shown to be related to *Bacillus abortus*. Three varieties of this type were distinguished. The variety occurring most frequently was designated *B. abortus*, variety *lipolyticus*, because it decomposes milk fat. In its cultural characteristics this variety agrees closely with Bang's original description of *B. abortus*. Cultures of this variety were shown to be capable of imparting undesirable flavors and odors to cream kept under conditions to which cream is frequently subjected. Two other varieties of *B. abortus* type differed considerably from the *lipolyticus* variety, but resembled the cultures isolated from pathogenic sources and studied for comparison. Cultures of *B. abortus* type were isolated from 45 of the 192 samples studied. The highest number of these bacilli found per cubic centimeter was 50,000.

The author concludes that "there is a definite udder flora comprising bacteria which belong to parasitic types. It is not surprising that the majority of udder bacteria should be of the same type as those common on the skin and mucous membrane of man and animals. The majority of the staphylococci on the skin are of the nonvirulent variety, which fails to produce pigment and fails to ferment mannite. But pathogenic varieties also are found on the skin, where they ordinarily cause no trouble. Similarly, the majority of the staphylococci of the udder are nonvirulent, but varieties which are capable of causing death when inoculated into experimental animals occasionally establish themselves in healthy udders. Whatever the variety may be, conditions in the udder are favorable to multiplication, and frequently large numbers are eliminated in the milk.

"The pathogenic properties of the streptococci and bacilli common in milk when it leaves the udder are not discussed in this paper, but they also are parasitic in their nature.

"When a bacterial culture is tested for its pathogenic properties the body tissues and fluids are exposed directly to the toxins of the culture in question. When organisms enter into the digestive tract with the food the circumstances

are different, for the body tissues and fluids are protected by the mucous membranes against the ravages of the bacteria that enter with the food. Therefore it can not be assumed that bacteria which are pathogenic to inoculated laboratory animals would be injurious to human beings when present in the milk consumed. It is a subject worthy of investigation. But since the bacteria of the udder are parasitic in their nature, and since pathogenic varieties are sometimes eliminated in considerable numbers from healthy udders, the data here reported add evidence to the growing conviction that all milk is safer for consumption after it has been pasteurized."

Studies on the formation of gas in milk, B. W. Hammer (*Iowa Sta. Research Bul. 27 (1916), pp. 3–16, figs. 3*).—Gas forming organisms were isolated from several cases of gassy curds and their action on milk both alone and in combination with *Bacterium lactis acidi* was studied.

"The curds secured with the gas formers alone did not resemble the original curd, since but a small amount of gas was held in the curd, while double inoculations gave extremely gassy curds. It is probable that the gassy curds occur with the double inoculations, because a firm curd which will retain the gas results from the acid produced by *B. lactis acidi* while the gas formation is still in progress. On continued transferring the gas formers lost their ability to produce extremely gassy curds when grown in combination with *B. lactis acidi*, and this was accompanied by a decreased acid production in inoculated milk held at 37° C. for one week. It seems likely that the decreased acid tolerance is responsible for the failure to produce extremely gassy curds. Other cultures of gas formers grown in combination with *B. lactis acidi* failed to produce extremely gassy curds, probably because of their failure to grow in the presence of acid. Cultures of *B. lactis acidi* from different sources seemed to be equally effective in the production of gassy curds when grown with the gas formers isolated.

"*B. lactis acidi* influenced the total amount of gas produced by the gas former, sometimes increasing it and sometimes decreasing it at 37°, and always decreasing it at room temperature. *B. lactis acidi* influenced the type of curd formed very materially because of the part it played in causing a retention of the gas.

"The gas-forming organisms from the four cases described were not all the same. *B. communior* and *B. ærogenes* were the two types encountered."

Comparison of the bacterial count of milk with the sediment or dirt test, H. C. Campbell (*U. S. Dept. Agr. Bul. 361 (1916), pp. 6, pl. 1*).—The author gives results of an experiment to determine whether the sediment or dirt test can be wholly relied upon as a means of detecting insanitary milk at milk receiving stations. In the experiment the Gerber, the Wizzard, and the Lorenz (E. S. R., 23, p. 180) apparatus were used. Pint samples of milk were collected on the railroad station platform from the milk cans as they arrived from various farmers. After preparing plates, sediment tests were made and the disks were compared with the bacterial counts.

Comparing the bacterial count with the Gerber sediment test with unfiltered market milk, it was found that "some samples had a high bacterial count, yet tested 'good' or 'fair' with the sediment test, while others which had a low bacterial count tested 'medium' or 'bad.'" With the Wizzard sediment test, one sample classed as "good" by the sediment test contained 4,102,000 bacteria per cubic centimeter, while another classed as "bad" contained only 243,000 bacteria per cubic centimeter. With the Lorenz sediment test one sample with a bacterial count of 768,000 tested "fair" by the sediment test, and one with a count of 7,200 bacteria per cubic centimeter tested "bad."

In comparisons with filtered milk 10 samples out of 20 filtered through 4-ply cheesecloth varied in bacterial count from 24,000 to 639,000 per cubic centimeter. Ten average samples out of 20 filtered through one ply of Canton flannel varied in bacterial count from 18,000 to 316,000 per cubic centimeter. Ten average samples out of 20 filtered through 1-ply ordinary absorbent cotton, covered above and below with 1-ply cheesecloth, varied in bacterial count from 31,400 to 760,000 per cubic centimeter. Every sample of filtered milk was classed as good by the Lorenz sediment test.

It is concluded that the result of a sediment test is no criterion as to the kind or number of bacteria contained in the milk. The various sediment tests, while applicable in roughly estimating the quantity of sediment in unstrained milk, can not be used as the sole means of determining the hygienic conditions under which the milk was produced. Sediment testers are deemed of little value in estimating the degree of contamination in milk strained through the substances mentioned. The Lorenz apparatus is considered the most convenient and practical for demonstrating dirt in milk.

The grading of milk, E. KELLY (*Hoard's Dairyman, 52 (1916), No. 1, pp. 1, 6, figs. 3*).—A discussion of the history and development of the grading of milk, reasons for grading, and systems of grading.

Sanitary condition of dairies (*U. S. House Representatives, 64. Cong., 1. Sess., Hearings before Committee on Rules on House Resolution 137, 1916, pp. 101*).—This reports hearings before a House committee as to the sanitary condition of dairies in the United States.

A new pasteurizing apparatus for bottled milk, WEIGMANN, A. WOLFF, M. TRENSCH, and M. STEFFEN (*Milchw. Zentbl., 44 (1915), Nos. 13, pp. 193–202, figs. 2; 14, pp. 209–217*).—An apparatus for the pasteurizing of bottled milk, based on the "holder" method is described, together with data on its efficiency in bacterial destruction.

The biorizator, ORLA-JENSEN (*Milchw. Zentbl., 44 (1915), No. 18, pp. 273–277, fig. 1*).—The biorizator method and apparatus for pasteurizing milk is described and data given showing its efficiency in reducing the bacterial content without detriment to the quality of the milk.

Biorized milk, K. E. F. SCHMITZ (*Milchw. Zentbl., 44 (1915), No. 16, pp. 241–245, figs. 3*).—A discussion of the biorizator and its efficiency in bacterial destruction.

Result of the Lobeck method of milk sterilization (biorization), K. E. F. SCHMITZ (*Ztschr. Hyg. u. Infektionskrank., 80 (1915), No. 2, pp. 233–260, figs. 5*).—Experiments with the Lobeck biorizator indicated that it is an effective method of sterilizing milk without impairing the quality, taste, or nutritive value. It was effective in destroying tubercle bacilli.

A simple steam sterilizer for farm dairy utensils, S. H. AYERS and G. B. TAYLOR (*U. S. Dept. Agr., Farmers' Bul. 748 (1916), pp. 11, figs. 8*).—A simple and inexpensive yet efficient steam sterilizer is described which can be provided at a cost of from \$5 to \$10. It is believed that the sterilizer described is cheap enough to justify its use on any farm from which milk or cream is sold. It is designed to be of greatest use to those who have one, two, or three 10-gal. or smaller cans with a similar number of pails and a strainer cloth, but can be used with a larger number of cans.

When properly operated this sterilizer destroys practically all the bacteria in the utensils, including all disease germs which may be present. It will accomplish the same results as any sterilizer in which steam not under pressure is used. Experiments with this sterilizer show that the 5-minute steaming is, for practical purposes, as good as the 15- to 30-minute steaming usually recommended.

Dry milk or cream powder and a process for its manufacture, S. A. VASEY and U. A. CLEEVE (*English Patents, 2772 (1915); 7766 (1915); abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 11, pp. 649, 650*).—"The particles of a milk or cream powder are coated with a layer of an odorless, liquid hydrocarbon which is nonvolatile at ordinary temperature (e. g., Paraffinum liquidum, B. P.); the product will keep unaltered for a considerable period. Such a powder is produced by projecting milk powder by means of an air blast into an atomized spray of the hydrocarbon, or by mixing the milk, or partially evaporated milk, with the hydrocarbon and then drying the mixture. The finished product should contain not more than 5 per cent of its weight of the hydrocarbon."

VETERINARY MEDICINE.

The third and fourth reports of the director of veterinary research, A. THEILER (*Rpts. Dir. Vet. Research, Union So. Africa, 3-4 (1915), pp. 632, figs. 154*).—These reports consist of 17 papers by various authors as follows:

Contribution to the Study of Deficiency Disease, With Special Reference to the Lamziekte Problem in South Africa, A. Theiler, H. H. Green, and P. R. Viljoen (pp. 9–68); Sheep Scab.—Observations on the Life History of *Psoroptes communis* var. *ovis*, and Some Points Connected with the Epizootiology of the Disease in South Africa, by A. W. Shilston (pp. 71–98); Experiments and Observations Carried Out with *P. communis* at Onderstepoort, by G. A. H. Bedford (pp. 101–111); The Sulphur Sheep Dips, by H. H. Green (pp. 115–161); Report upon the Dipping Trials Carried Out with the Different Proprietary and Homemade Sheep Dips in South Africa, by G. A. H. Bedford (pp. 165–172); Upon the Composition and Analysis of Polysulphid Solutions (pp. 175–195) and Arsenical Dip Tester (pp. 199–214), both by H. H. Green; Infectious or Pernicious Anemia of Equines in South Africa, by A. Theiler and D. Kehoe (pp. 217–289); Investigations Into the Life History of the Wireworm in Ostriches, by A. Theiler and W. Robertson (pp. 293–345); The Anatomy and Life History of the *Hæmonchus contortus*, by F. Veglia (pp. 349–500); Some Observations in Connection with the Immunization of Cattle Against South African Redwater and Genuine Gall Sickness (Anaplasmosis), by J. Walker (pp. 503–526); The Cultivation of *Anaplasma marginale* in vitro, by F. Veglia (pp. 529–532); Aspergillosis in the Ostrich Chick (pp. 535–574), and A Short Note on the Occurrence of *Cytodites nudus* in the Domestic Fowl in South Africa (pp. 577–581) both by J. Walker; Investigations into Jagziekte or Chronic Catarrhal Pneumonia of Sheep, by D. T. Mitchell (pp. 585–614); Report on *Acokanthera venenata*, G. Don, from the Transvaal (pp. 617–623); and On the Transmission of *Hæmoproteus columbæ*, by R. Gonder (pp. 627–632).

Veterinary work in Argentina, WEHRLE (*Arb. K. Gsndhtsamt., 50 (1915), No. 2, pp. 164–302*).—This paper presents details of veterinary work, statistics relating to domestic animals, etc., for Argentina, continuing the series previously noted (E. S. R., 34, p. 576).

Text-book of meat hygiene, R. EDELMANN, trans. by J. R. MOHLER and A. EICHHORN (*Philadelphia: Lea & Febiger, 1916, 3. rev. ed., pp. VI+17–452, pls. 5, figs. 161*).—This is the third revised English edition and authorized translation revised for America (E. S. R., 21, p. 163).

Fumigation of cotton seed by gaseous hydrocyanic acid, F. HUGHES (*Agr. Jour. Egypt, 5 (1915), No. 1–2, pp. 84–90*).—The experiments reported led to the conclusion that "although minute quantities of hydrocyanic acid have been found in all samples of treated seed examined, the amount is so small that no fear need be entertained as to its proving in any way toxic. The acid appears

to be for the most part expelled or destroyed in the process of 'cooking' preparatory to the extraction of the oil.

"The quantity of hydrocyanic acid found in the cake prepared from treated seed is so small that it would in no way interfere with its use as cattle feed. No hydrocyanic acid could be detected in the partly refined oil. No alteration in its character or properties could be detected. The considerable absorption of hydrocyanic acid gas by cotton seed appears to be very largely due to the solubility of the gas in the oil contained in the seed."

The biologic reactions of the vegetable proteins.—VII, Anaphylaxis reactions between proteins from seeds of different genera of plants, H. G. Wells and T. B. Osborne (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 183–193*).—Continuing work previously noted (E. S. R., 34, p. 577) it is concluded that since chemically similar proteins from seeds of different genera react anaphylactically with one another, while chemically dissimilar proteins from the same seed fail to do so in many cases, the specificity of the anaphylactic reaction depends on the chemical structure of the protein molecule.

Certain nonspecific reactions obtained with antigens made from bacteria grown on serum media, J. K. Olitsky and E. Bernstein (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 253–259*).—"The injection of serum-grown bacteria into animals for the purpose of producing immune serum for comparative serologic studies is to be avoided. Such a method results in the production of a precipitating serum *v.* the serum present in the media. The antiserum thus formed reacts in a nonspecific manner to various bacteria grown on serum media in regard to precipitation, agglutination, complement-fixation, and formation of cellular antibody."

A comparison of the natural hemolytic activity of fresh human sera against guinea-pig and sheep erythrocytes, H. W. Wade (*Jour. Med. Research, 34 (1916), No. 1, pp. 113–119*).—From the study it is concluded that natural antiguinea-pig hemolytic activity occurs in human sera with considerable regularity and uniformity of concentration. This hemolytic combination is deemed superior to the natural antisheep cell hemolysins as a serological reagent, since the latter appears less constantly and with greater variability of concentration.

The influence of exposure to X-rays upon the formation of antibodies, J. P. Simonds and H. M. Jones (*Jour. Med. Research, 33 (1915), No. 2, pp. 183–196, fig. 1*).—In the experiments reported rabbits were exposed daily to X-rays for from 10 to 15 minutes for a period of three weeks. Immediately following the exposure a single large dose of killed typhoid bacilli was given intraperitoneally to each animal.

The exposure to the X-rays was found to lower appreciably the formation of agglutinins. No marked difference was observed in the opsonic content and complement-fixing power of the serum of X-rayed animals compared with controls. It is deemed that the results obtained in a study of the bacteriolysins for typhoid bacilli do not warrant a positive statement. The indications are, however, that the production of bacteriolysins was not greatly interfered with by exposure to X-rays.

The effect of injections of benzol upon the production of antibodies, J. P. Simonds and H. M. Jones (*Jour. Med. Research, 33 (1915), No. 2, pp. 197–211, figs. 2*).—In these experiments rabbits were injected subcutaneously with a mixture of 1 part benzol and 2 parts olive oil in such doses that the animals received approximately 1 cc. of benzol per kilogram of body weight.

Sharp individual differences were noted in the effect of the injections upon the leucocytes and erythrocytes of the different animals. A depression in the

production of hemolysins, agglutinins, and opsonins was observed in the injected animals, as compared with normal controls injected with the same antigen. The depression was most marked in the case of hemolysins and least so in the case of opsonins.

On the concentration of antitoxic sera, ANNIE HOMER (*Biochem. Jour., 10 (1916), No. 2, pp. 280–307, figs. 3*).—The work reported shows that the advantages claimed by Banzhaf [a] for the one-fraction process in the concentration of sera are often vitiated by the fact that a final product is obtained which on account of the presence of an opalescent suspension, presumably euglobulin, can not be filtered except after long standing. The successful preparation of an easily filterable end product has been found to depend on the initial heating of the serum mixtures. The heating process does not cause a conversion of pseudoglobulin into euglobulin, but merely serves to complete the aggregation of the euglobulin into particles sufficiently large to admit of separation by filtration.

The uncertainty with regard to the successful heating of the serum mixtures is obviated by the addition of 1.5 per cent sodium chlorid. It is deemed possible that the addition of sodium chlorid exerts a favorable influence on the filtration process by an adjustment of the hydrogen-ion concentration of the serum mixtures.

Observations with regard to the effect of the addition of sodium chlorid to the serum mixtures have also been made and are reported in detail.

A multiple pipette for the complement-fixation test, J. M. BUCK (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 267–271, figs. 3*).—A pipette by means of which twelve portions of either normal salt solution, complement, sensitized serum, or any of the other elements used in serological diagnosis can be distributed at one time is described, as well as a special container for the substance to be distributed and a modified test-tube rack. The multiple pipette not only permits of indefinitely greater progress with greater accuracy but also eliminates the severe eye strain resulting from the constant reading of the type of pipette generally used.

Hemolytic streptococci found in milk: Their significance and their relation to virulent streptococci of human origin, D. J. DAVIS (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 236–252, figs. 2*).—The results of the study reported are summarized as follows:

"Hemolytic streptococci, having a wide clear zone, occur commonly in both pasteurized and unpasteurized (certified) milk. These strains vary among themselves. They are more resistant to heat than human strains of hemolytic streptococci, and possess little or no virulence for rabbits, therefore in all probability none for man. They rapidly acidify and coagulate milk, and grow well at 20° C. They form short or long chains, but as seen in milk often appear in pairs or a chain of few elements. While they are definitely hemolytic . . ., the characteristics of the hemolytic zone on plates may vary in certain respects.

"The milk strains are different from certain strains of hemolytic streptococci found at times in diseased udders in cows. These latter resemble the strains of hemolytic streptococci from human sources, and are virulent for rabbits.

"There is no reason to consider that these organisms have any sanitary significance. The importance, however, of certain types of hemolytic streptococci in relation to epidemics of sore throat makes it necessary to study carefully all such organisms in milk. By itself the hemolytic property has no more value for identification purposes than many other characteristics, but is greatly important on account of the practical value of the blood-agar-plate method as a

[a] Collected Studies Bur. Lab. Dept. Health N. Y. City, 7 (1912–13), pp. 114–116.

means of initial separation of human type strains from the many strains of nonhemolytic and feebly hemolytic streptococci found in milk."

A comparative study of colon bacilli isolated from horse, cow, and man, T. J. MURRAY (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 161–174, figs. 2*).—From the work reported it is concluded that the different types of strains, human, bovine, and equine, exhibit a remarkable similarity in the reactions tested, chiefly in acid production. In general the average amount of acid produced by each type tended to decrease as the complexity of the tested substance increased.

"With mannite, dextrose, and lactose, the organisms have a high point of acid production at which the larger percentage of the strains belong. The other strains for the greater part lie immediately on either side of this high point. The acid production for the larger number is confined to narrow limits. The high points of acid production do not lie far apart with dextrose, lactose, and mannite. They coincide in the case of mannite. In general with saccharose, raffinose, and salicin this high point is neither clearly shown nor definitely marked. The acid production varies greatly and is spread over a large area."

The mode of infection in pulmonary distomiasis.—Certain fresh water crabs as intermediate hosts of Paragonimus westermanii, K. NAKAGAWA (*Jour. Infect. Diseases, 18 (1916), No. 2, pp. 131–142, pls. 4, figs. 2*).—This is the article referred to in the paper previously noted (E. S. R., 35, p. 384).

Investigations of foot-and-mouth disease, IV, E. KALLERT (*Arb. K. Gsndhtsamt., 50 (1915), No. 2, pp. 159–163, pls. 2*).—This fourth contribution (E. S. R., 34, p. 879) deals with the changes which take place in the rumen of cattle affected with foot-and-mouth disease.

Mortality among grazing animals in Germany due to Simulium reptans, MATTHIESEN, PEETS, and DAHLGRÜN (*Berlin, Tierärztl. Wchnschr., 31 (1915), No. 36, pp. 421–425, fig. 1; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 11, pp. 1499, 1500*).—For ten years a disease has been recorded among grazing animals in the districts of Neustadt-am-Rübenberge and Fallingbostel, located on the low ground near the rivers Aller and Leine, Prussia, which regularly causes the death of a large number of cattle, usually a short time after they are turned out to pasture. Horses are only rarely attacked. Investigations made regarding the disease show that the death of the animals is due to the bite of *S. reptans*.

Some observations on the methods of using the agglutination test in the diagnosis of disease in bovines caused by the bacillus of contagious abortion, H. R. SEDDON (*Proc. Roy. Soc. Victoria, n. ser., 27 (1915), No. 2, pp. 370–390*).—The author discusses the study reported under the topics of materials required on which to found a diagnosis of contagious abortion, technique employed, and quantitative factors in the agglutination reaction.

In determining whether the relation of the quantity of pure serum to the degree of dilution or the amount of pure serum in the tube is the determining factor in agglutination of a particular serum, it is concluded that "tubes possessing the same dilution (but different quantities) of serum do not furnish parallel results. . . . Tubes containing the same quantity of serum do furnish parallel results. The agglutination titer varies with the quantity of emulsion used." The dominating factor on an agglutination system is, therefore, the quantity of serum in each tube, and not the degree of dilution.

Studies on the optimum amount of emulsion for use in the test are also reported.

Different types of streptococci and their relation to bovine mastitis, G. MATHERS (*Jour. Infect. Diseases, 19 (1916), No. 2, pp. 222–235*).—The author has corroborated the findings of Davis and Capps (E. S. R., 31, p. 482) that

hemolytic streptococci of human origin produce mastitis in cows when injected directly into the milk ducts.

"This mastitis may be severe, leading to a caked bag and later to a chronic inflammatory condition which results in an atrophy of the mammary gland. On the other hand, virulent hemolytic streptococci may grow and multiply in the milk ducts of a cow without causing any visible changes in the udder. The milk, however, . . . contains hemolytic streptococci and an increased number of leucocytes. These infections may persist over long periods of time in the form of a chronic mastitis.

"*Streptococcus lacticus* of the type used in these experiments produces a very acute inflammation of the udder when cultures are injected directly into the milk ducts. This infection . . . was of short duration and left the gland functionally unchanged. A nonpathogenic hemolytic streptococcus of the type commonly found in normal milk may give rise to a transitory inflammation of the udder when injected directly into the milk ducts, producing a mastitis similar in every detail to that produced by nonhemolytic *S. lacticus.* The presence of pathogenic streptococci and an increased number of leucocytes in milk is indicative of a mastitis, and may be the sole indication of mastitis.

"The quarters of a cow's udder under experimental conditions are apparently separate as regards infection. One quarter may be infected, while the others remain normal. Examination of the milk from each quarter of the udder is necessary before mastitis can be excluded in a suspected cow.

"In three instances of bovine mastitis, all of which were due to hemolytic streptococci with all the characteristics of the human types, no noteworthy changes in the morphology or cultural characteristics of the invading organisms were observed in frequent examinations of the milk throughout the course of the infections. The distinguishing characteristics primarily noted for each organism were still present at the last observation, and there were no modifications which might be considered as indicating a change from one type to the other. The cultural and morphological characters of *S. lacticus* and of the hemolytic streptococcus derived from normal milk did not change during the course of the udder infections which they induced."

Control and eradication of infectious mastitis in dairy herds, H. Moak (*Cornell Vet., 6 (1916), No. 1, pp. 36–40*).—Considerable success has been met with in the control of this disease by dipping the teats after milking in a weak solution of one of the newer high-powered antiseptics, pyxol, wescol, or hycol (one teaspoonful to 3 pints or 2 qt. of water), for six or seven seconds. Reports from several herds affected with mastitis state that from the time this treatment was started no new cases developed. The practice is now made obligatory on 12 farms furnishing certified milk for Brooklyn, N. Y.

Effects of feeding cotton seed and its products to swine, G. A. Roberts (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 1, pp. 12–17*).—A digest of investigational work of the several divisions of the North Carolina Experiment Station during the past six years.

"While several agents [sulphate of iron, ashes, etc.] have proved efficient in prolonging the period of safe feeding of cotton-seed meal no practical means for eliminating the toxic element, or elements, has as yet been developed. The writer believes that the effect of the above agents is purely chemical in rendering the gossypol, and possibly other toxic substances, nontoxic. He has noted with others that hogs having range and rooting a great deal apparently gain minerals from the soil and forage which enable them to withstand the cotton-seed meal longer than when confined, especially when on a board floor. Since iron salts did not prevent all deaths, and that a number of iron-fed swine developed conspicuous rheumatic symptoms, the writer does not believe iron to be

the logical antidote, but has hopes that a safe method of feeding the meal to swine will be discovered." See also a previous note (E. S. R., 34, p. 79).

Feeding experiments with Bacterium pullorum.—The toxicity of infected eggs, L. F. RETTGER, T. G. HULL, and W. S. STURGES (*Jour. Expt. Med., 23 (1916), No. 4, pp. 475–489*).—" The problem of eradicating ovarian infection in the domestic fowl assumes still greater importance than heretofore in the light of data recently acquired. Not only is it of great significance to eliminate the permanent carriers of *B. pullorum* from all flocks of fowls from the standpoint of successful poultry breeding, but also because they constitute a possible source of danger to man.

" Eggs which harbor *B. pullorum* in the yolk in large numbers may produce abnormal conditions, when fed, not only in young chicks but in adult fowls, young rabbits, guinea pigs, and kittens. The toxicity for young rabbits is most pronounced, the infection usually resulting in the death of the animals. In kittens the most prominent symptoms are those of severe food poisoning with members of the paratyphoid group of bacteria. The possibility of infected eggs causing serious disturbances in young children and in the sick and convalescent of all ages must therefore receive serious consideration.

"Ovarian infection of fowls is very common throughout this country. Hence, a large proportion of the marketed eggs are infected with *B. pullorum*. When such eggs are allowed to remain in nests under broody hens, or in warm storage places, for comparatively few hours, they contain large numbers of the organism.

" Soft boiling, coddling, and frying on one side only do not necessarily render the yolks free from viable bacteria; therefore, eggs which have gone through these processes may, like raw eggs, be the cause of serious disturbances in persons who are particularly susceptible to such influence, and especially to infants."

Morphology of adult and larval cestodes from poultry, J. E. GUTBERLET (*Trans. Amer. Micros. Soc., 35 (1916), No. 1, pp. 23–44, pls. 4*).—" By morphological comparison of the cysticercoids produced experimentally in flies and adult of *Choanatænia infundibuliformis* they are shown to be identical. Morphological points noted are the presence of minute hooklets on the suckers and entire surface of scolex in *C. infundibuliformis*. The manner of development of uterus in the same species is by means of a blind tube which grows in size, forming pockets, and later breaks up into small compartments. In *Davainea tetragona* the genital pores were found to occur irregularly alternate in the proglottids. The hooks on the rostellum of *D. cesticillus* were found to vary in length from 8 to 12 μ. The uterus in development first appears as a solid cord of cells which becomes hollow and in growing forms pockets, filling the entire proglottid."

The studies here presented relate to those previously noted (E. S. R., 35, p. 577.) A bibliography of 26 titles is appended.

Further investigations into the etiology of the protozoan disease of turkeys known as blackhead, entero-hepatitis, typhlitis, etc., T. SMITH (*Jour. Med. Research, 33 (1915), No. 2, pp. 243–270, pls. 5*).—" Putting together the data at hand, certain facts seem to stand out quite clearly. The parasite, from the fact of its destructive effect on the young bird's life, is poorly adapted to its young host. The process of invasion into the walls of ceca and liver is not adjusted to the discharge of parasites for passage to another host. The parasites are buried within the host lesions. Again, the cycle as observed is obviously incomplete. There is all told a remarkable want of adaptation of means to ends such as we find so fully developed in the coccidia and protozoan blood parasites, for instance.

"The evidence points to several possible theories rather widely divergent. The disease may represent a kind of aberrant parasitism, the true host being some other species. Or the parasite may undergo its normal development in the contents of the ceca, and the invasion of the tissues may be abnormal. Or there may be still other stages and an intermediate host. These views can only be definitely proved or disproved with the aid of the experimental method. The writer does not feel committed to any one of these hypotheses. The results obtained on feeding in 1913 and on exposing young artificially reared turkeys to young diseased turkeys in 1914 were not definite enough to prove that infection is direct from diseased bird to healthy, and they will require repetition and amplification.

"In casting about for a satisfactory method for raising trustworthy birds for experimental work the writer found that healthy turkeys could be reared from infected flocks by using the incubator and brooder. This procedure has made it fairly evident that blackhead is not transmitted in the egg, although more trials are needed before we can be certain of this."

Aberrant intestinal protozoan parasites in the turkey, T. Smith (*Jour. Expt. Med., 23 (1916), No. 3, pp. 293–300, pl. 1*).—"There are so many points of difference between the blackhead parasite and the unknown parasite of the mucous membrane as encountered in this single case, that any attempt to present them would require an elaborate restatement of what is now published. Assuming that they are different, we are confronted with the fact that, even after the blackhead parasite shall have been eliminated, the outlook for raising turkeys without some losses due to avian coccidia and perhaps other still unknown protozoan parasites is not very encouraging. Fortunately the mortality due to these aberrant parasites was low. In any case the specific sources of coccidia and other parasites must be found and dealt with."

Hasstilesia tricolor, a common parasite of rabbits in the United States, M. C. Hall (*Jour. Amer. Vet. Med. Assoc., 48 (1916), No. 4, pp. 453–456*).—The author erects the genus Hasstilesia for *Distoma tricolor* described from *Sylvilagus mallurus* (*Leptus sylvaticus*) and *L. americanus* by Stiles and Hassall in 1894. This is a very common intestinal parasite of rabbits in Maryland, Virginia, and the District of Columbia and is also recorded from New York and Texas.

RURAL ENGINEERING.

Reports on irrigation for the year 1915, E. F. Drake and F. H. Peters (*Dept. Int. Canada Ann. Rpt. 1915, pt. 7, pp. 23*).—This includes the reports of the superintendent and the commissioner of irrigation of Canada.

Venturi meter succeeds in irrigation (*Engin. News, 75 (1916), No. 24, pp. 1122, 1123, figs. 3*).—A description of the adaptation of this well-known device to the measurement of irrigation water is given.

Determination of the maximum storm-water flow, C. E. Grunsky (*West. Engin., 5 (1914), No. 6, pp. 254–256, fig. 1*).—This is a description of a new method of solving the problem of rate of maximum run-off, involving a discussion of the elements affecting its determination, the derivation of the Grunsky formula for maximum rain intensity, and tabulated data showing its application. The formula is $I=\frac{C}{\sqrt{t}}$, in which I=intensity in inches per hour, t=time in minutes, and C=a coefficient to be determined from rain records.

Determination of maximum stream flow, C. E. Grunsky (*West. Engin., 7 (1916), pp. 217–219*).—From the formula for storm-water flow applicable to small areas, noted above, an expression for maximum stream flow is developed,

which it is stated may be applied to even the largest streams. Examples are given based on the actual discharge of several rivers.

Control of the Colorado River as related to the protection of Imperial Valley, J. C. ALLISON (*Proc. Amer. Soc. Civ. Engin., 42 (1916), No. 5, pp. 681–709, figs. 10*).—The more important details of this work are described.

The drainage of the humid and saline soils of the Egyptian Delta, É. CATZEFLIS (*Egypte Contemporaine, No. 27 (1916), pp. 324–354, pl. 1*).—This article deals with the technique and economics of the drainage of the humid and saline soils of Egypt.

The results of physical tests of road-building rock, P. HUBBARD and F. H. JACKSON, JR. (*U. S. Dept. Agr. Bul. 370 (1916), pp. 100, . 1*).—This bulletin and Bulletin 347 (E. S. R., 34, p. 890) together constitute a complete revision of Office of Public Roads Bulletin 44 (E. S. R., 27, p. 587), and furnish the results of physical tests of road-building rock made in the laboratories of the United States Office of Public Roads and Rural Engineering to January 1, 1916. It has been assumed that traffic of less than 100 vehicles per day is light, between 100 and 250 moderate, and over 250 heavy.

"The ideal rock for the construction of a water-bound macadam road resists the wear of traffic . . . to that extent which will supply a sufficient amount of cementitious rock dust to bind the larger fragments in place. . . . As determined by test, cementing values [for rocks] below 25 are called low; from 26 to 75, average; and above 75, high. In general, the cementing value should run above 25. For rocks which show a low French coefficient of wear, a relatively high cementing value is more necessary than for those which have a high French coefficient. . . .

"Experience has shown that in general the following table of limiting values for the French coefficient of wear, toughness, and hardness may be used in determining the suitability of a rock for the construction of the wearing course of a macadam road:

Limiting values of physical tests of rock for water-bound macadam road construction.

Character of traffic.	Limits of tests.		
	French coefficient of wear.	Toughness.	Hardness.
Light	5–8=(5–8 per cent wear)	5–9	10–17.
Moderate	8–15=(2.7–5 per cent wear)	10–18	Over 14.
Heavy	Over 15=(less than 2.7 per cent wear)	Over 18	Over 17.

"As a result of comparing hardness and toughness tests of some 3,000 samples, . . . when any given value for toughness falls within certain limits which define the suitability of the material for macadam road construction under given traffic conditions, the corresponding value for hardness will fall within similar limits for hardness. . . . The great majority of samples having a French coefficient of wear of from 5 to 8 and a hardness of over 17 are granites, quartzites, and hard sandstones, which are unsuited for use in the wearing course of water-bound macadam roads due to their lack of binding power.

"For broken-stone roads which are maintained with dust palliatives, the same limits for French coefficient of wear and toughness should hold as for ordinary macadam roads. In bituminous work in some cases it is advantageous to use a rock of relatively high absorption rather than one with low absorptive quali-

ties, owing to a better adhesion of the bituminous material by a partial surface impregnation of the rock."

The following table "may be used as a general guide for minimum limits of French coefficient of wear and toughness in connection with bituminous broken-stone roads."

Minimum limits of physical tests of rock for bituminous-road construction.

Type of road.	Light to moderate traffic.		Moderate to heavy traffic.	
	French coefficient of wear.	Toughness.	French coefficient of wear.	Toughness.
Broken stone with bituminous carpet. Bituminous broken stone with seal coat.	5=(not over 8 per cent wear).	5	7=(not over 5.7 per cent wear).	10
Bituminous concrete with or without seal coat.	7=(not over 5.7 per cent wear).	7	10=(not over 4 per cent wear).	13

Construction and maintenance of earth roads, L. V. Edwards (*State Col. Wash., Dept. Ext. Bul. 20 (1916), pp. 35, figs. 29*).—This bulletin is intended to give some suggestions to road supervisors and others interested in improved roads as to how to construct and maintain earth roads. The subjects dealt with are grading, grades, widths, drainage, and maintenance.

Brick roads, V. M. Peirce and C. H. Moorefield (*U. S. Dept. Agr. Bul. 373 (1916), pp. 40, pls. 12, figs. 4*).—A revision of Bulletin 246 (E. S. R., 33, p. 686).

Rules and regulations of the Secretary of Agriculture for carrying out the Federal Aid Road Act. D. F. Houston (*U. S. Dept. Agr., Office Sec. Circ. 65 (1916), pp. 24*).—The text of the act (E. S. R., 35, p. 200), and of the rules and regulations, is given.

Factors of apportionment to States under Federal Aid Road Act appropriation for the fiscal year 1917 (*U. S. Dept. Agr., Office Sec. Circ. 62 (1916), pp. 2*).—This circular presents the factors of apportionment and the amounts apportioned to each State for the fiscal year 1917 under the Federal Aid Road Act.

Fifth, sixth, seventh, and eighth annual reports of the state roads commission [of Maryland] for the years 1912–1915 (*Ann. Rpts. State Roads Com. Md. 5–8 (1912–1915), pp. 175, pls. 22*).—This reports the activities and expenditures of the commission for the years 1912–1915.

Report of the State Highway Department of Washington for the period October 1, 1912, to October 1, 1914, W. R. Roy (*Rpt. State Highway Dept. Wash., 1912–1914, pp. 192, figs. 42*).—This is an outline of the various phases of work undertaken by the Washington Highway Department, together with a survey of highway conditions in the State and practical suggestions and information.

Bridge foundations, W. Burnside (*New York: D. Van Nostrand Co., 1916, pp. VIII+139, figs. 32*).—This book deals with foundations for abutments and piers of bridges crossing rivers or other waters.

"The different kinds of foundations in common use and the methods by which they are placed in position are described. The conditions suited to each kind are noted and where necessary and possible the principles of design are indicated. Next to nothing, however, is said with regard to cost and in reference to plant."

The subject matter includes chapters on the foundation bed, abutment foundations, pier foundations, piled foundations, dams, screw piles and screw

cylinders, well foundations, standard caissons, open caissons, pneumatic caissons, and the effects of compressed air.

Tables giving data on loads on foundations, skin friction, properties of materials, pile-bearing formula, steel sheet piling, quantities and cost for the pier of the American River bridge, decompression periods, and stage decompression are appended.

Economy in bridge design and construction, H. W. Joyce (*Calcutta: Bengal Secretariat Book Depot, 1915, pp. [IV]+98, pl. 1, figs. 55*).—This is a series of six lectures on the subject delivered to the students of the Sibpur Engineering College.

Value of the high-pressure steam test of Portland cements, R. J. Wig and H. A. Davis (*U. S. Dept. Com., Bur. Standards Technol. Paper 47 (1915), pp. 34, pls. 2, figs. 4; abs. in Sci. Abs., Sect. B—Elect. Engin., 19 (1916), No. 220, p. 127*).—Investigations made to establish "if possible, a relationship between the behavior of Portland cements in high-pressure steam and their physical properties under normal conditions of use and exposure and to determine what value, if any, the high-pressure steam test has as a means of detecting unsoundness which might cause a weakening or disintegration of the cement or concrete" are reported.

"The qualitative high-pressure steam test used consists of subjecting an ordinary soundness pat, which has been stored for 24 hours in a damp closet, to a steam pressure of 300 lbs. per square inch for at least one hour, the total time in the high-pressure boiler being three hours. A cement was said to pass this test when it exhibited no cracking, warping, or disintegration on examination after the treatment.

"The quantitative high-pressure steam test consists of molding six briquettes of neat cement at normal consistency, storing these test pieces 24 hours in a damp closet, then subjecting three of them to an atmosphere of steam at 300 lbs. pressure for at least one hour; the total time in the high-pressure boiler being three hours. The briquettes (both treated and untreated) are then broken in a shot-testing machine. A cement was said to pass this test when the treated briquettes exhibited greater strength than the untreated ones."

The following conclusions are drawn from the results obtained:

"The high-pressure steam test should be made on all cements that are incorporated in cement, mortar, or concrete products that are to be cured in steam at pressures above atmospheric. The high-pressure steam test may be of value as forecasting the behavior of neat cement or a very rich mortar when exposed under normal conditions in dry air, but it will not forecast the behavior of cements in concretes as normally exposed. The cement passing the high-pressure steam test is not superior in cementing quality, as determined from the compressive strength of concretes, to cement that fails to pass this test. The cement passing the high-pressure steam test does not make more permanent or durable concrete than cement which meets the requirements of the standard specification, but fails to pass this test. Cement failing to pass the standard specification atmospheric steam test, but meeting the other requirements of the standard specification shows in some instances a normal strength in concrete. For practical work under normal conditions of construction the results of this investigation fail to show that the high-pressure steam test is of value as a means of determining the ultimate soundness of concrete."

Testing the belt power of a tractor, E. C. Gee (*Power Farming, 25 (1916), No. 6, p. 9, figs. 2*).—This is a brief illustrated description of the prony brake test as applied to a tractor.

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Mechanical tillage experiments at Grignon, France, in 1914 and 1915, Brétignière and Ringelmann (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 36 (1915), No. 23, pp. 532–536; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 8, pp. 1093–1095*).—Experiments begun in 1913 with a Flemish plow drawn by oxen, a tractor and plow outfit, a motor plow, two rotary cultivators, and two tractor and cable outfits are reported. The soil was a shallow calcareous clay in the first set of experiments. After wheat, a catch crop of white mustard was sown and plowed in by the various machines, one on each plat, while one plat was plowed by a Flemish double "turn-wrist" plow drawn by oxen, after which Grey Houdan oats were sown on all of them. In the second series the soil was fairly deep loam, with oats following lucern. The yields are shown in the following table:

Crop results after mechanical tillage.

Kind of implement.	First series.					Second series.				
	Straw.	Grain.	Chaff, etc.	Total.	Ratio of straw to grain.	Straw.	Grain.	Chaff, etc.	Total.	Ratio of straw to grain.
	Lbs. per acre.	*Lbs. per acre.*	*Lbs. per acre.*	*Lbs. per acre.*		*Lbs. per acre.*	*Lbs. per acre.*	*Lbs. per acre.*	*Lbs. per acre.*	
Flemish plow drawn by oxen	2,750	2,170	491	5,411	127 : 100	3,613	3,256	580	7,449	111 : 100
Tractor and plow	3,360	1,948	803	6,111	173 : 100	3,379	3,155	625	7,159	107 : 100
Motor plow	3,360	2,409	661	6,430	130 : 100	2,989	2,632	635	6,256	115 : 100
Windlass tractor						3,569	3,279	578	7,426	109 : 100
Tractor hauling on cable						3,212	2,766	647	6,625	116 : 100
Rotary cultivator (1)	2,469	1,753	326	4,548	141 : 100	3,345	3,055	647	7,047	120 : 100
Rotary cultivator (2)	2,542	1,725	491	4,758	147 : 100					

In all the machine-tilled plats in the first series the ratio of straw to grain was greater than in the one plowed by oxen. In the second series the plat plowed by the windlass tractor yielded a crop similar in quantity and ratio of straw to grain to that obtained by the Flemish plow.

In both fields the rotary digger gave lower yields than the Flemish plow, while the results of the tractor and plow and motor plow differed in the two fields. In the first field the crops were heavier than those obtained on the work of the Flemish plow, while in the other field they were inferior. It was also found that in the first field the ground was not too moist and it has been plowed as well by the tractor as by the Flemish plow and decidedly better than by the motor plow. In the tractor-plowed plat the white mustard had been turned in better than by the Flemish plow. On the whole the plats plowed by the tractor and the motor plow were better prepared than the plat worked by oxen. "In the second field, on the other hand, the ground was wet; the work of the tractor left room for criticism while that of the motor plow was quite unsatisfactory."

Dust explosions and fires in grain separators in the Pacific Northwest, D. J. Price and E. B. McCormick (*U. S. Dept. Agr. Bul. 379 (1916), pp. 22, pls. 11*).—Field and laboratory experiments on the causes of dust explosions in grain separators conducted in cooperation with the University of Idaho and in consultation with the Washington Experiment Station (E. S. R., 32, p. 386) are reported, together with descriptions of preventive devices developed as a result of the investigation.

It was found that explosions were generally distributed among all types of separators, both steel and wood, and that fires occurred also in the combination

type. Of 117 fires 95 were dust explosions, and of 108 fires 82 originated back of the cylinder or very near that point. "About 75 per cent of the occurrences were assigned to the presence of static electricity and to smut explosions. . . . The invesigations show conclusively that the presence of a hot box is not essential in order that an explosion may take place. . . .

"As a result of the investigations . . . it is believed that a complete system of electrical connection from all of the moving parts to a common wire, and a thorough grounding of this common wire, will prevent a large percentage of the fires that are due to the presence of static electricity and an explosive mixture of smut dust and air." The use of a suction fan attached to the top of the separator and near the cylinder which exhausts from above the cylinder and from below the fan is also advocated.

An automatic fire extinguisher which was tested and found to be satisfactory is also described. This consists essentially of a tank mounted on top of the separator and containing a bottle of sulphuric acid and water containing soda. Other accessories are a discharge pipe extending throughout the separator and fitted with spray nozzles, a tripping mechanism, and a set of fuses mounted in a wire line.

"The presence of sufficient heat within the separator will melt one of the fuses. This breaks the wire line, releasing the trigger, which frees the tripping mechanism, causing a hammer within the tank to strike a blow sufficient to break the bottle. The discharge of the sulphuric acid into the water containing soda causes the formation of carbon dioxid, which generates sufficient pressure to force the water through the discharge pipe and the nozzles to all the crevices of the separator. . . .

"The locations [of fuses] will vary with each machine, and must be selected so that the fuses are sure to be reached by the flame or the heat, but not so placed that the wire connecting them is likely to be broken by the straw or by the moving parts of the separator.

"The location of the nozzles depends upon the construction of the machine, but the following points should be observed:

"Locate one nozzle directly above the cylinder, if possible; if not, place it so that the beater will help diffuse the spray from that nozzle. Run the pipe line along underneath the roof of the separator, with the nozzles pointing downward. Install a sufficient number of nozzles along this line, and so locate them that every chamber in the separator is thoroughly served by a nozzle. Particular pains should be taken to serve dead air spaces, as it is in these that dust is likely to accumulate. As the stacker end of the machine is less likely to contain any closed chambers, it is probable that, in most types of machines, the nozzles at this end may be 30 in. or more apart. The last nozzle along the pipe line and within the separator should be just above the end of the shakers."

Combination barns for prairie farms, A. R. Greig and A. M. Shaw (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 1 (1915), pp. 54, figs. 21*).—This bulletin describes and illustrates the structural details of four combination barns and gives bills of materials.

Dairy barns, ice and milk houses for prairie farms, A. R. Greig and A. M. Shaw (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 2 (1915), pp. 66, figs. 20*).—This bulletin describes and illustrates the structural details of four dairy barns and two ice and milk houses.

Beef cattle barns for prairie farms, A. R. Greig and A. M. Shaw (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 3 (1915), pp. 53, figs. 18*).—This bulletin describes and diagrammatically illustrates a beef cattle breeding barn, feeding shed, and feeding barn and discusses details of roof framing, mangers, stalls, a portable grain table, and a portable feeder.

Horse barns for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 4 (1915), pp. 50, figs. 16*).—This bulletin describes and illustrates the structural details of four horse barns and discusses the details of roof framing, stalls, and ventilation.

Sheep barns for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 5 (1915), pp. 34, figs. 13*).—This bulletin describes and illustrates the structural details of four sheep barns and of feeding devices and gives bills of materials.

Piggeries and smokehouse for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 6 (1915), pp. 38, figs. 13*).—This bulletin describes and illustrates the structural details of two permanent piggeries, a portable piggery, and a smokehouse, and gives bills of materials.

Poultry houses for prairie farms, A. R. GREIG and R. K. BAKER (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 7 (1915), pp. 35, figs. 12*).—This bulletin describes and illustrates the structural details of one permanent and two portable poultry houses, trap nests, feed hoppers, and a coop for a setting hen, and gives bills of materials.

The pullet laying house, G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul. 4 (1916), No. 4, pp. 12–20, figs. 2*).—This describes the construction of a pullet laying house adapted to Washington conditions.

Commercial poultry house equipment, MR. and MRS. G. R. SHOUP (*Washington Sta., West. Wash. Sta. Mo. Bul., 4 (1916), No. 5, pp. 3–11, figs. 4*).—This article describes the necessary furnishings and equipment for the efficient handling of laying pullets.

Implement sheds and granaries for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 8 (1915), pp. 38, figs. 10*).—This bulletin describes and illustrates the structural details of a portable granary, two permanent granaries, and two implement sheds, and gives bills of materials.

Silos and root cellars for prairie farms, A. R. GREIG and A. M. SHAW (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 9 (1915), pp. 38, figs. 17*).—This bulletin describes and illustrates the structural details of two stave silos and a root cellar and gives bills of materials.

Silos and silage, H. L. BLANCHARD (*Washington Sta., West. Wash. Sta. Mo. Bul. 4 (1916), No. 4, pp. 2–10, figs. 7*).—This is a brief description of the stave, wooden hoop, concrete, and pit silo, and methods of silo filling.

Houses for prairie farms, A. R. GREIG and L. B. BEALE (*Brit. Columbia Dept. Lands, Forest Serv., Farm Build. Ser. Bul. 10 (1916), pp. 70, figs. 29*).—This bulletin describes and diagrammatically illustrates six farmhouses, gives bills of materials, and discusses septic tanks and methods of laying out farms.

Modern plumbing illustrated, R. M. STARBUCK (*New York: The Norman W. Henley Publishing Co., 1915, 3. ed., rev. and enl., pp. 407, figs. 58; rev. in Engin. News, 75 (1916), No. 24, pp. 1134, 1135*).—This book contains 58 figures illustrating the details of different types and methods of plumbing. It is designed to cover the entire field of plumbing as far as possible. "It takes up not only plumbing as practiced in towns and cities under strict plumbing regulations, but plumbing construction under conditions obtaining in country districts, where the problems which arise are often of an entirely different nature, and where there is not in existence any public regulation of sanitary work.

"The subjects considered cover a variety of lines of work, including fixture work in detail, the construction of the drainage and vent systems in detail, and complete plumbing systems of buildings of various kinds. The work is designed essentially to cover subjects pertaining to drainage alone, but it is clear that in

many instances the subject of water supply is closely associated with the drainage problem, and the author has therefore deemed it advisable in several instances to go somewhat into the general subject of water supply. This is especially true of country plumbing systems and of the systems of large city buildings."

Sewage disposal for country homes, F. M. WHITE and E. G. HASTINGS (*Wis. Col. Agr. Ext. Serv. Circ. 60 (1916), pp. 15, figs. 12*).—This is a popular illustrated discussion of the subject. See also a previous publication from the Wisconsin Station by Ocock and Wright (E. S. R., 28, p. 86).

RURAL ECONOMICS.

Labor requirements of crop production, T. P. COOPER, F. W. PECK, and A. BOSS (*Minnesota Sta. Bul. 157 (1916), pp. 55, figs. 2*).—In 1902, cost-of-production studies were started in three counties in Minnesota. Cost data were gathered by personal visits to farms, and 15 farms were selected in each locality which were visited daily by an agent to obtain labor records and weight of feeds and dairy products. These data were collected yearly since that date for 10 years, although the number of farms was reduced to 8 in each locality. As a result of the studies, data were obtained as to the average annual hours of labor required per acre in producing various field crops, as follows:

Average annual hours of labor per acre required in producing field crops, 1902–1912.

Kind of crop.	Northfield, Rice County.		Marshall, Lyon County.		Halstad, Norman County.		Average, all farms.	
	Man.	Horse.	Man.	Horse.	Man.	Horse.	Man.	Horse.
	Hrs.	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*	*Hrs.*
Wheat, shock-threshed	14.5	28.0	12.2	29.4	10.8	28.2	12.3	29.9
Oats, shock-threshed	14.7	28.2	12.2	30.0	11.7	29.6	13.5	28.9
Barley, shock-threshed	14.8	27.9	13.3	31.4	11.9	29.5	12.8	29.9
Fall rye, shock-threshed	......	....	10.2	27.0	10.4	27.5	10.3	27.2
Flax, stack-threshed	15.0	31.0	15.6	40.2	12.9	32.6	13.7	33.8
Corn, husked	30.1	53.6	22.6	51.6	30.9	57.6	26.2	54.2
Fodder corn, cut, shocked, and stacked	33.7	54.1	25.0	51.0	33.1	52.8	30.4	52.6
Silage	33.7	56.0	......	....	31.5	63.5	32.6	59.8
Hay, timothy and clover, first crop	12.7	11.8	11.0	13.4	12.6	13.8	12.3	13.0
Hay, timothy and clover, two cuttings	21.3	20.3	15.6	23.0	......	....	20.7	21.5
Hay, wild	9.1	10.0	11.2	13.5	13.5	20.7	12.2	16.9
Timothy, cut for seed	......	....	6.0	8.5	4.4	6.1	5.1	7.1
Clover, cut for seed	10.1	11.3	8.1	13.6	......	....	9.2	12.3
Hay, millet	18.5	36.3	16.9	39.1	17.3	39.5	17.3	39.1
Hemp	14.3	27.4	......	....	......	....	14.3	27.4

In commenting upon the amount of labor required, the authors make the following statement:

"Increased productivity per laborer may be obtained either by extending the farm operations or by increasing the yields per acre. The extensive type of agriculture is based on the distribution of a man's labor over the greatest possible crop acreage, thus obtaining large productivity per labor unit. It is typified by the use of large-capacity machinery and of mechanical power such as steam or gasoline. In this type of agriculture each man performs a maximum of service through the aid of equipment; that is, of capital invested in equipment. . . .

"The gross returns from each unit of labor used in crop-production may increase to the point of maximum yields. . . . Additional labor should be utilized

on crops only to the point where yields give increased net returns. When this point is reached, it is better management to apply this labor to additional acres, and thus obtain a maximum return for the additional units applied, than to apply additional labor to the crop on the same land and obtain merely equal returns. In other words, if the returns for each unit of additional labor on a given acreage do not show increase, the operation should become more extensive."

Data as to the hours of labor required in marketing farm crops and a comparison of shock-threshing v. stack-threshing are also given.

Waste land and wasted land on farms, J. S. Ball (*U. S. Dept. Agr., Farmers' Bul. 745 (1916), pp. 18, figs. 12*).—The author has classified the nonproductive farm areas as follows: Land unnecessarily taken up by farm buildings and lots, unnecessary lanes and roads, fence rows, open ditches, headlands, or turning spaces bordering fields and terraces; the part of any public road included in a farm area; land rendered untillable by swamps, rocks, etc.; woodland not yielding salable products; and uneconomic pasture land.

He discusses these various types in general and with special reference to information obtained in connection with farm management surveys on 1,703 farms, in nine States. Wide variations in the percentage of the total farm acreage occupied by nonproductive areas were found, both between different regions and on individual farms in the same locality.

Size of farm business, O. R. Johnson and W. E. Foard (*Missouri Sta. Bul. 140 (1916), pp. 3–40, figs. 12*).—This bulletin is the second based on data secured in a survey of four townships in the western part of Johnson County (E. S. R., 32, p. 791). Among the conclusions reached by the authors from this study are the following:

"There are several factors which play a part in determining the size and profitableness of the farm business. First in importance in a diversified farming region is the number of acres operated. The larger farms have a more favorable distribution of capital than the smaller farms. They have as large a percentage of tillable ground and less waste land than the small farms. More of the large farm is kept in grass. The large farm is more heavily stocked with live stock other than work stock. One animal unit is kept for each 6.6 acres of crops on the small farm while only 4.8 crop acres are grown for each animal unit on the larger farm.

"The operator of the larger farm is employing his men, horses, and equipment more efficiently than is the man on the smaller farm. . . . The horse on the large farm cares for 21.2 crop acres while on the small farm he has only 7.3 acres to care for. . . .

"The receipts and expenses per acre are practically the same on large and small farms. . . . The large farm seems to be able to get better results from the feeding of cattle and the return from feeding hogs are at least as good. . . .

"The labor income on a certain-sized farm is limited by the capital investment. Some farms are too heavily capitalized and others do not have enough capital invested. The most successful farms in each group have an investment of from $70 to $95 per acre. . . .

"The man with a low capital investment per acre is giving so much attention to grain farming that his system does not give him enough productive labor. Where the capital is larger, the farmer is able to keep more live stock and thus secure more regular employment. This influences his labor income to quite an extent."

The farmer's income, E. A. Goldenweiser (*U. S. Dept. Agr., Farmers' Bul. 746 (1916), pp. 7, fig. 1*).—This study is based upon the data available regarding farmers' incomes in the reports of the Census and the investigations of the Office of Farm Management and the States Relations Service.

From a study of the Census data, dealing with 6,362,000 farmers, the author concludes that the gross income of the farmer is $1,236 per farm, out of which he pays $512 in farm expenses, leaving a net earning of $724 available for family expenses, payments on mortgage, and savings. After deducting interest on the investment at 5 per cent, there is left $402 as labor income produced by the family.

The investigations of the Office of Farm Management indicate that the average earnings of 4,018 farm families were $952, of which $400 represented the value of the house rent, food, and fuel supplied by the farm. The data obtained through the farm management demonstrations of the States Relations Service indicated that the average labor income on 4,400 farms was approximately $800.

The author commenting on these data states that "the average farm family makes approximately as much for its labor as the average industrial family, but owing to the lower cost of living on the farm and the interest earned by the farm investment, the average farm family occupies a much more secure economic position than does the average city family."

The farmer's income, E. A. Goldenweiser (*Amer. Econ. Rev., 6 (1916), No. 1, pp. 42–48, fig. 1*).—This article includes a large portion of the above data.

Costs and sources of farm-mortgage loans in the United States, C. W. Thompson (*U. S. Dept. Agr. Bul. 384 (1916), pp. 16, pls. 5*).—In this publication data are given as to the average interest rate and the average annual commission by States for farm-mortgage loans, and the proportion of the total mortgages in each State distributed according to the rate of interest paid. Data are also given showing the percentage of the total farm mortgages held by life insurance companies and by banks, factors which influence the terms on farm-mortgage loans, the need for improved facilities, and the desirability of State and Federal legislation.

The author summarizes his conclusions as follows:

"Being given a properly organized credit system, it is believed that the farmer who adopts business methods in his farming and thus shows himself worthy of credit will have adequate opportunity to secure it on reasonable terms. The farmers' need in connection with mortgage credit is to obtain investment capital for relatively long periods of time, on suitable terms of repayment, and at the lowest cost consistent with business policy. A properly organized system should supply this need, and, under suitable Federal regulation and control, should protect the farmer against the unreasonable charges now prevailing in many localities."

Some observations on the bulk handling of grain for California, B. H. Crocheron and C. J. Williams (*California Sta. Circ. 152 (1916), pp. 24*).—The advantages and disadvantages of handling grain in bulk and in sacks are discussed, and data on the cost of handling grain by these methods are given. The cost of handling sacked grain after harvesting is estimated at $3.915 per ton as compared with $2.90 for bulk handling.

Rules and regulations of the Secretary of Agriculture under the United States Cotton Futures Act of August 11, 1916 (*U. S. Dept. Agr., Office Sec. Circ. 64 (1916), pp. 27*).—This circular contains rules and regulations promulgated by the Secretary of Agriculture relative to the United States Cotton Futures Act (E. S. R., 35, p. 307), as well as a copy of the act itself.

Agricultural associations and the war, P. Sagourin (*Ann. Sci. Agron., 4 ser., 4 (1915), No. 10–12, pp. 382–397*).—In this article are discussed the influence of the war upon the French agricultural associations and some of the functions performed by them under war conditions.

Rome's fall reconsidered, V. G. SIMKHOVITCH (*Polit. Sci. Quart., 31 (1916), No. 2, pp. 201–243*).—In this article the author points out the influence of the agricultural practice and the methods of holding land upon the decline of the Roman Empire.

Monthly crop reports, July and August, 1916, (*U. S. Dept. Agr., Mo. Crop Rpt., 2 (1916), Nos. 7, pp. 61–72; 8, pp. 73–84, figs. 8*).—These numbers contain the usual data relative to acerage and condition of the principal crops, average prices paid to producers, estimated farm value, the range of prices of agricultural products at important markets, and miscellaneous data.

No. 7.—This contains a statement relative to the amount of commercial fertilizers sold in the cotton States, a special report on honey yields and prospects, and a review of the tobacco situation and the condition of truck crops for canning. In commenting regarding the prices of wool the following statement is made:

"The average price paid to producers of the United States for unwashed wool in the past month was 28.7 cts. per pound, which compares with 23.7, 18.4, 15.6, 18.7, 15.5, and 19.5 cts., respectively, in June of the past 6 years. . . . The average weight of wool per fleece this year is abount 6.92 lbs."

No. 8.—Special articles are included on the commercial acreage and production of onions, the acreage in watermelons and cantaloups in 1915 and 1916, receipts and exports of Durum wheat, and the largest yield per acre of various crops produced on single fields or plats in different parts of the United States.

AGRICULTURAL EDUCATION.

School credit for home practice in agriculture, F. E. HEALD (*U. S. Dept. Agr. Bul. 385 (1916), pp. 27*).—The author discusses (1) methods for teachers' use in giving rank for home work in agriculture and applying that rank with proper weight to the general scholarship average of the pupil, and (2) the basis of such rank or credit for the benefit of school officials who desire to introduce home practice in agriculture as an educational feature into rural schools. Supplementay tables of labor requirements and selected club records of boys' and girls' work are included.

Public elementary schools and food supply in war time (*Jour. Bd. Agr. [London], 23 (1916), No. 1, pp. 33–40*).—This is the text of a memorandum issued by the English Board of Education, upon request of the president of the Board of Agriculture and Fisheries, to local education authorities, school managers, teachers, parents, and others interested in the work of elementary schools, calling attention to the need for maintaining and increasing the supply of home-grown food of all kinds. The memorandum, without giving detailed suggestions for carrying them on, briefly indicates some minor industries and occupations for increasing the food supply which have been or can be taken up in connection with rural and semirural schools, such as gardening, keeping live stock, poultry, rabbits, bees, pigs, and goats, making jam, evaporating and bottling fruits, and the drying of savory herbs in connection with cookery classes, collection of wild fruits, etc., and farm handicraft.

[State-aided vocational agricultural education in 1915] (*Ann. Rpt. Bd. Ed. [Mass.], 79 (1916), pp. 185–193, 293–299, 320, 321; Bul. Bd. Ed. Mass. No. 54 (1916), pp. 19*).—This report is devoted to the present achievements of the two county agricultural high schools in Bristol and Essex Counties, respectively, and the future prospects of this type of school, and to statistical data on the three vocational agricultural schools and 13 agricultural departments in selected high schools, with reference to receipts and expenditures, teachers, student enrollment, distribution of graduates, activities, including judging and

other contests, earnings of agricultural pupils from farm and other work for the years 1912–1915, inclusive, and project work.

Short courses (*Agr. Gaz. Canada, 3 (1916), No. 4, pp. 310–324, figs. 4*).—This is a review of the short courses in agriculture and home economics offered in the Provinces of Prince Edward Island, Nova Scotia, Quebec, Manitoba, and Saskatchewan.

School garden plans for 1916 (*Agr. Gaz. Canada, 3 (1916), No. 4, pp. 355–361*).—The plans for school garden work for 1916 in the Provinces of Prince Edward Island, Nova Scotia, Ontario, Manitoba, Saskatchewan, and British Columbia, are outlined.

A school garden organization, F. W. Bates (*Agr. Gaz. Canada, 3 (1916), No. 5, pp. 459–462, figs. 4*).—A sketch of the organization and development of the work of the Lost River Municipal School Garden Association in Saskatchewan as an illustration of the success of school gardening organized as a community project.

Report of the Minister of Agriculture, Industry, and Commerce for 1914, M. E. De Queiroz Vieira (*Relat. Min. Agr. Indus. e Com., Brazil, No. 1 (1914), pp. XXXIV+204, pls. 41*).—This report includes an account of the progress in 1914 of agricultural education and reearch institutions in Brazil, comprising the Higher School of Agriculture and Veterinary Medicine at Rio de Janeiro, a secondary or theoretical-practical school of agriculture, 8 agricultural apprentice schools, 1 permanent dairy school, 5 experiment stations, of which 2 are in process of organization; 5 demonstration fields, 2 sericultural stations, 3 zootechnical stations, 4 model stock-breeding farms, and the botanical garden, national museum, and forest nursery, and of agricultural extension work.

The Danish people's high school including a general account of the educational system of Denmark, M. Hegland (*U. S. Bur. Ed. Bul. 45 (1915), pp. 182*).—Part I of this bulletin gives a general account of the educational system of Denmark. Part II deals with the origin, growth, life, aims, curricula, methods, influence, and results of the people's high schools in Denmark, gives brief accounts of similar schools in Norway, Sweden, Finland, Germany, England, and the United States, and discusses the adaptation of these schools to American conditions. Tables, giving statistics of students, teachers, and number of hours of instruction devoted to each subject in a five months' course in the people's high schools and agricultural schools in Denmark, and a bibliography are appended.

Activities of the Italian Colonial Agricultural Institute, G. B. Gioli (*Agr. Colon [Italy], 10 (1916), No. 1–2, pp. 94–104*).—This is a report, by the director, on the regulations, staff, curriculum, experimental work, and finances for 1914–15 of the Italian Colonial Agricultural Institute at Florence.

The Bavarian forestry schools, Esslinger (*Ztschr. Forst. u. Jagdw., 47 (1915), No. 9, pp. 568–572*).—The author discusses the training required for admission to the forest management and forest protection service, including the new regulations requiring a four-year course in a forest school after the completion of the seven-year Bavarian public school course.

Regulations for the training of teachers of agricultural home economics (*Min. Bl. K. Preuss. Verwalt. Landw., Domänen u. Forsten, 10 (1914), No. 5, pp. 80–109*).—Detailed information is given concerning the training of agricultural housekeeping teachers in Prussia, including (1) the admission requirements; (2) an outline of the one-year course of instruction in cooking, baking, preserving, housekeeping, laundering, sewing, physics, chemistry, botany, the origin, nutritive and economic value, utilization, and adulteration of foodstuffs, marketing, hygiene and sanitation, psychology and pedagogy, civics and rural welfare, household accounts and bookkeeping, animal husbandry, including pig

raising, dairying, poultry raising, and fruit, flower and vegetable gardening; (3) time schedules showing the distribution of subjects and time devoted to theoretical and practical instruction in each; (4) exercises in cooking, baking, and preserving; and (5) written and theoretical-practical oral examination requirements, the former including two theses on methods of teaching and agricultural and home economics subjects, respectively. This training is given in the agricultural seminars of six of the farm and home management schools designated by the Minister of Agriculture, Domains, and Forests, viz, at Obernkirchen, Maidburg, Bad Weilbach near Flörsheim, Mallinckrodthof at Paderhorn, and Luisenhof at Bärwalde.

Scientific informations (*Netherlands East Indian San Francisco Com., Dept. Agr., Indus. and Com., Essay No. 8 (1914), pp. 91, pls. 18*).—Part 1 of this pamphlet gives a history of the Department of Agriculture, Industry, and Commerce of Netherlands East India, and an account of its present organization and work. Part 2 deals with the history and work of private experimental stations, the cost of which is borne privately but which nevertheless form a part of the agricultural department or are in some way connected with it.

MISCELLANEOUS.

Annual Report of Iowa Station, 1915 (*Iowa Sta. Rpt. 1915, pp. 22*).—This contains the organization list and a report by the director and vice director on the work of the station, including a financial statement for the fiscal year ended June 30, 1915.

Twenty-ninth Annual Report of Nebraska Station, 1915 (*Nebraska Sta. Rpt. 1915, pp. XXXVII, figs. 6*).—This contains the organization list, a report as to the work and publications of the year, a report of the extension service of the college of agriculture, and a financial statement for the period ended June 30, 1915. Data as to animal husbandry and dairying are abstracted elsewhere in this issue.

Monthly bulletin of the Western Washington Substation (*Washington Sta. West. Wash. Sta. Mo. Bul., 4 (1916), Nos. 4, pp. 20, figs. 10; 5, pp. 16, figs. 4*).—These numbers contain brief articles on the following subjects:

No. 4.—Silos and Silage, by H. L. Blanchard (see p. 690); Summer Pruning, by J. L. Stahl; and The Pullet Laying House, by G. R. Shoup (see p. 690).

No. 5.—Market for Mole Skins, by W. A. Linklater; Commercial Poultry House Equipment, by Mr. and Mrs. G. R. Shoup (see p. 690); Rye in Western Washington, by E. B. Stookey; Black Spot Canker on the Pear, by A. Frank; Select Plants for Potato Seed, by J. L. Stahl; and Molting, by Mrs. G. R. Shoup.

Successful farming, F. D. Gardner (*Philadelphia: J. C. Winston Co., 1916, pp. 1088, pls. 9, figs. 452*).—This treatise is termed "a ready reference on all phases of agriculture for farmers of the United States and Canada." It is divided into ten main parts, viz, soils and soil management; farm crops; horticulture, forestry, and floriculture; live stock farming (animal husbandry); dairy farming (dairy husbandry); farm buildings and equipment; farm management; plant and animal diseases, insect enemies and their control; home economics and agricultural education; and tables of weights, measures, and agricultural statistics. Many of the chapters are contributed by members of the instruction staff of the Pennsylvania College and other institutions.

The autobiography of a farm boy, I. P. Roberts (*Albany, N. Y.: J. B. Lyon Co., 1916, pp. IV+331, pls. 7*).—This autobiography gives considerable space to the author's work at the Iowa College and Cornell University, including graphic accounts of some of the conditions and difficulties encountered in organizing agricultural instruction and research in the pioneer days at these institutions. The introduction is by Dr. L. H. Bailey.

NOTES.

Connecticut College and Stations.—W. M. Esten, who has previously served on both the college and Storrs Station staffs as bacteriologist, has been transferred wholly to college work. Miss C. J. Mason, assistant bacteriologist in the station, has also been transferred to college work. Miss E. B. Whittlesey, herbarium assistant of the State Station, resigned October 1.

Georgia College and Station.—In the college, Dr. L. M. Roderick, instructor in veterinary medicine, resigned August 1, and F. H. Denniss, cooperative field agent in dairying, on October 15. I. W. Arthur has been appointed instructor in animal husbandry, effective September 1, and W. C. Burkhart, D. V. M., instructor in veterinary medicine, effective October 15.

C. A. Wells has resigned as chemist in the station, effective November 1.

Purdue University and Station.—P. R. Edgerton, W. R. Palmer, and O. H. Anderson have resigned, the first named to become a county agent in Illinois, and the remainder to take positions as farm managers. S. P. Smyth has resigned as instructor in poultry husbandry. R. S. Thomas has been appointed assistant in soils and W. R. M. Scott as assistant in farm crops. C. D. Kinsman has been transferred to extension work in rural engineering and C. C. Cunningham has been appointed in charge of drainage work. H. W. Gregory, assistant in dairying in the South Dakota College, has been appointed assistant in dairying. F. H. Beach has been transferred to extension work in horticulture and W. H. Stevenson and F. J. Sutton have been appointed instructors in that subject. H. C. Paine, D. V. M., has been appointed instructor in veterinary science and associate veterinarian in the station and will have charge of the testing of commercial serums.

Maryland Station.—Soil investigations under a special state appropriation have been begun, with A. G. McCall in charge, P. E. Richards as laboratory assistant, and S. W. Phillips as field assistant. R. L. Hill, Ph. D., has been appointed biochemist in dairy research.

Minnesota Station.—The station has recently adopted the policy of regarding all research assistants who devote at least one-half time to work on station projects as members of the staff. Under this plan the following additions to the staff were made at the opening of the present fiscal year: A. M. Gurjar, S. Sato, R. A. Thuma, and A. J. Wuertz, in agricultural biochemistry; J. C. Gillilan and Frank Robotka, in agricultural economics; M. N. Levine, in bacteriological investigations; Samuel Graham and S. Marcovitch, in entomology; A. W. Aamodt, in horticulture; G. R. Hoerner, in plant pathology; and A. L. Anderson, in veterinary science.

G. R. Bisbee has been appointed assistant plant pathologist, R. P. Ingram and Fern Pack, assistant seed analysts, and L. J. Hood, assistant editor, these dating from August 1.

Missouri University and Station.—J. O. Rankin has resigned as agricultural editor to become associate professor of agricultural economics at the Iowa College, and was succeeded November 1 by M. N. Beeler, agricultural editor at the University of Florida. A. R. Evans, instructor in farm crops, has resigned

to accept a position in the Office of Markets and Rural Organization of the U. S. Department of Agriculture.

Montana College and Station.—The chemical building was burned October 20. All the records, the chemistry library, and considerable apparatus were saved. D. S. Fox, Ph. D., has been appointed assistant professor of farm management.

New Jersey College and Station.—An international egg-laying and breeding contest is being conducted under the auspices of the stations at Vineland, N. J., beginning November 1 and continuing for three years. The contest is open to all poultrymen. One of the purposes in view is to throw light on some of the principles of breeding in fowls, especially of the inheritance of fecundity and other characteristics.

Work is being begun on a greenhouse for the department of plant pathology.

S. A. Waksman, H. E. Carney, and Charles H. Richardson have resigned, the first named to accept a fellowship in the University of California, the second to become instructor in the biological sciences and agriculture in the Middletown Township High School, and the third to become assistant in biological chemistry at Columbia University. Recent appointments include Alvah Peterson, Ph. D., as instructor in entomology and assistant entomologist; Miss Nevada S. Evans, as assistant seed analyst; James W. Day, as assistant in agronomy; Joseph R. Neller, as research assistant in soils; and Thurlow C. Nelson in charge of oyster research.

North Carolina College and Station.—The Annual Farmers' Convention held at the college August 29–31, under the auspices of the college, station, and extension workers, was one of the most successful meetings of its kind yet held in the State. About 3,000 men and 2,000 women were in attendance. The special subject of the meeting was rural education, which was graphically presented by means of an exhibition in which several booths were grouped around a larger booth in one of the college buildings. The smaller booths represented the activities of the station and extension service, while the larger booth represented a consolidated or farm-life school. This exhibit attracted much attention from visitors.

E. A. Hodson, assistant professor of agronomy, has been given a year's leave of absence for graduate study, and his work is being taken by J. O. Ware, formerly agent for Columbus County. H. L. Joslyn, assistant professor of soils, has resigned to become superintendent of the Craven County Farm-life School and has been succeeded by T. H. Stafford. George H. Rea has been appointed specialist in bee keeping under a cooperative arrangement between the Bureau of Entomology of the U. S. Department of Agriculture and the extension service. D. G. Sullins has been appointed assistant in animal husbandry and dairying, J. H. Hall, assistant in plant breeding, vice Buxton White, resigned to become alumni secretary for the college, and C. C. Logan, extension specialist in soils.

Oregon College and Station.—The forestry building has been completed. A new swine feeding barn and laboratory is under construction and is expected to be ready for use in November.

Paul H. Crouter, a 1916 graduate, has been appointed superintendent of the Eastern Oregon substation at Union, and will have special charge of the cattle feeding experiments. D. E. Rickard, a member of the same class, has been appointed superintendent of the college live-stock farms, and Carey Lloyd Strome, a third member, has been selected as foreman of the seed crop farms. H. A. Schoth has accepted a position in vetch experiments in connection with the studies of the U. S. Department of Agriculture which are under way at the college.

Pennsylvania College and Station.—M. G. Kains, professor of horticulture and horticulturist, resigned October 1 and has been succeeded by Dr. S. W. Fletcher, formerly director of the Virginia Station. Earle L. Moffitt has been appointed assistant professor of farm management extension, effective November 13. A. B. Long, G. J. Kuhlman, and F. J. Holben have resigned as assistant chemists. R. H. Olmstead, a graduate of the college, has been appointed assistant in animal husbandry; H. Clyde Knandel, instructor in poultry husbandry extension; Albert F. Yeager and John S. Gardner, instructors in horticulture; and C. H. Hadley, jr., instructor in entomology extension.

Utah College and Station.—E. P. Taylor, professor of horticulture and horticulturist, has resigned to become director of agricultural extension at the University of Arizona. E. W. Stephens has been appointed assistant state leader of club work and will have charge of boys' clubs in the high schools. D. W. Pittman has accepted an appointment as instructor in agronomy and assistant agronomist.

Wisconsin University.—A. C. Baer, instructor in dairy husbandry, has resigned to become head of the dairy department of the Oklahoma College and Station.

Necrology.—Prof. Cleveland Abbe, widely known for his eminent services in meteorology in the Weather Bureau of the U. S. Department of Agriculture, died October 28 at the age of 78 years.

Professor Abbe was a native of New York City and educated at the College of the City of New York and Harvard University. He became assistant professor of engineering in the Michigan Agricultural College in 1859, and subsequently instructor in mathematics and astronomy at the University of Michigan. During the most of the Civil War he was a member of the U. S. Coast and Geodetic Survey, and from 1864 to 1866 a guest at the Nicholas Central Observatory near St. Petersburg, Russia.

On returning to this country he was appointed director of the Cincinnati Astronomical Observatory and in 1868 volunteered to make daily predictions of the weather for the benefit of the community. In September, 1869, he began the publication of a daily bulletin of weather probabilities based upon telegraphic reports from observers at a number of points. These forecasts soon attracted widespread attention.

A national bureau of storm warnings was established in 1870 under the direction of the Signal Service of the Army, and in the following year Professor Abbe became a scientific assistant in that work. During the long period of evolution of the U. S. Weather Bureau he was a prominent figure, editing the *Monthly Weather Review* in 1873 and again from 1892 to 1909, and the *Bulletin of the Mount Weather Observatory* during its entire period of publication. He was also the author of an extensive list of meteorological articles and several treatises.

Professor Abbe was a member of the National Academy of Sciences and of many other scientific organizations. He received in 1912 the Symons Memorial Gold Medal of the Royal Meteorological Society of England and recently the Marcellus Hartley Memorial Medal from the National Academy of Sciences, as well as the degree of LL. D. from the University of Michigan in 1888 and the University of Glasgow in 1896.

New Journals.—*Better Business*, a quarterly journal of agricultural and industrial cooperation, is being published by the staff of the Cooperative Reference Library of Dublin, Ireland. The initial number contains articles on the outlook for cooperators, the economics of continuous cropping, a translation of a report of the German Parliamentary Committee appointed to consider the ques-

tion of food supplies in war time, the development of the agricultural cooperative movement in England and Wales, reviews of the current literature on cooperation and related topics, etc.

Part 1 of Volume 1 of *Ectoparasites* has been issued and it is announced that succeeding parts will appear at irregular intervals. It is being edited by Dr. K. Jordan and N. Charles Rothschild. The initial part contains the following articles: On Some Siphonaptera Collected by W. Rückbeil in East Turkestan, by K. Jordan and N. C. Rothschild; Further Notes on *Siphonaptera fracticipita*, with Descriptions of New Genera and Species, by N. C. Rothschild; On Neopsylla and Some Allied Genera of Siphonaptera, by N. C. Rothschild; and Contribution to Our Knowledge of American Siphonaptera, by K. Jordan and N. C. Rothschild.

The State Plant Board of Florida has begun the publication of a *Quarterly Bulletin* devoted to applied entomology and plant pathology in general, with special reference to the prevention, control, and eradication of injurious insects and plant diseases in Florida. The initial number deals with citrus canker investigations.

The initial number of *Archivos do Jardim Botanico do Rio Janeiro* has recently been received. It contains three articles dealing with the flora of the region, and includes meteorological observations at the Garden in 1914.

Revista de la Sociedad de Medicina Veterinaria is being published by the Society of Veterinary Medicine of Buenos Aires. It is devoted mainly to original articles, bibliographical notes, the proceedings of the society, etc.

The Agricultural Journal is being published monthly by the department of agriculture of British Columbia, for the systematic dissemination of agricultural information.

Miscellaneous.—The Philippine Government has made available funds for the establishment of a permanent tobacco experiment station in the upper Cagayan Valley. The station is to be administered by the Bureau of Agriculture, with the Bureau of Internal Revenue and the College of Agriculture of the Philippines contributing advice and other assistance. D. B. Paguirigan and Alfonzo B. Cagurangan will be members of the staff.

At the last commencement of the University of the Philippines, the degree of Bachelor of Agriculture was conferred on nine candidates, that of B. S. in Agriculture on one candidate, and that of M. S. on two candidates.

A four-story annex to the Oka Agricultural Institute, Quebec, 160 by 63 feet, has been completed. This will be utilized mainly as a dormitory, but also contains classrooms for zootechny and field crops.

E. D. Ball, formerly director of the Utah Station, has been made state entomologist of Wisconsin, vice J. G. Saunders resigned to succeed H. A. Surface as economic zoologist of Pennsylvania.

According to a note in *Science*, C. B. Williams has been appointed to study the parasites of the sugar-cane frog-hopper in Trinidad.

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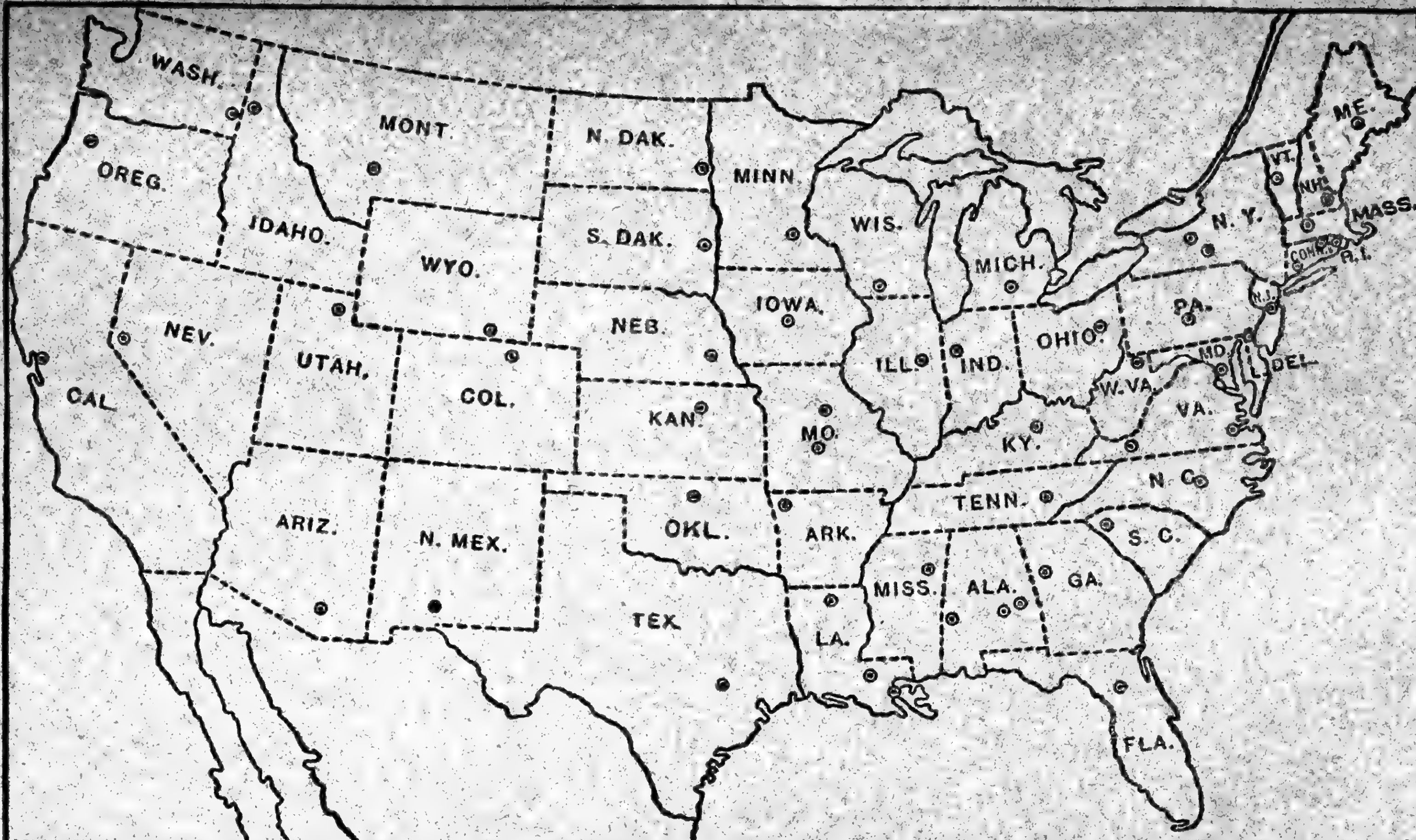

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U. S. DEPARTMENT OF AGRICULTURE
STATES RELATIONS SERVICE
A. C. TRUE, DIRECTOR

Vol. 35 DECEMBER, 1916 No. 8

EXPERIMENT STATION RECORD

WASHINGTON
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1917

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AGRICULTURAL EDUCATION.

LIST OF EXPERIMENT STATION AND DEPARTMENT PUBLICATIONS REVIEWED.

U. S. Department of Agriculture—Con.

U. S. Department of Agriculture—Con.

[a] Printed in scientific and technical publications outside the Department.

EXPERIMENT STATION RECORD.

VOL. 35. DECEMBER, 1916. No. 8.

Following the general policy adopted many years ago of meeting in alternate years in Washington, D. C., the Association of American Agricultural Colleges and Experiment Stations held its thirtieth annual convention in this city November 15–17. The selection of the nation's capital this year seemed especially appropriate, in view of the predominance in the program of questions of nation-wide significance, the important relationships developing with various branches of the Federal Government, and the plentiful evidences of the growing realization of the essential kinship and community of purpose of the institutions comprising the great Federal system of education and research for whose interests the association stands.

Official delegates were in attendance from every State in the Union except one, and from many institutions representatives were present for each of the four divisions of college, station, extension, and engineering activities. The total registration of delegates and visitors exceeded three hundred, and is believed to have eclipsed all previous records. This large attendance was doubtless due in part to the meetings of many related organizations and similar bodies.

Prior to the opening of the convention of the association itself, a four-day conference was held of the county agent leaders in extension work and the States Relations Service. The Society for the Promotion of Agricultural Science, the American Society of Agronomy, the National Potato Association, the National Association of State Universities, the American Association for the Advancement of Agricultural Teaching, the American Association of Farmers' Institute Workers, the Association of Feed Control Officials, and the Association of Official Agricultural Chemists also held sessions, and there was a conference of home economics teachers in the land-grant colleges under the auspices of the U. S. Bureau of Education. The annual meeting of the National Grange, this year celebrating its fiftieth anniversary, also brought to Washington a large number interested in agriculture, and a public meeting of this body, addressed

by President Wilson, tended further to focus attention in the city on matters pertaining to agriculture to an unusual degree.

The program of the Association of American Agricultural Colleges and Experiment Stations, however, was by no means restricted to agricultural lines. The interests of the association are, of course, considerably broader in scope, and this year in particular much emphasis was put upon what may be termed its nonagricultural phases. In the general sessions especially, aside from the addresses of the Secretary of Agriculture and the president of the association and the presentation and discussion of the reports of the standing committees, attention was centered quite largely on the proposed establishment by the Federal Government of engineering experiment stations, the development of military training in the land-grant colleges, and the best ways of conducting extension work in home economics and similar lines of interest to farm women. The prominent position accorded these topics, coupled with those presented at the two sessions of the newly formed subsection of engineering, gave to the program an appearance of less emphasis on the distinctively agricultural phases of the work than has been usual in recent years.

This trend of the convention, however, in no sense betokened a diminution of interest in agricultural education and research. On the contrary, it may be questioned whether the realization of the outstanding importance of these phases, and especially the need of adequate and systematic provision for research, was ever more strongly in evidence. For example, it was the dominating note in the presidential address, given by Director C. E. Thorne, of the Ohio Station, upon the subject of Progress of Education and Research in Agriculture. Director Thorne reviewed the history of the land-grant colleges, especially in their relations to the experiment stations, and sounded a note of warning that the temptation to neglect the work of the stations in order to take care of the great pressure for educational work must be strongly resisted if permanent progress is to be made. As he pointed out, "science can not stand still. Every extension of the horizon of our knowledge only expands the boundary of the unknown, and makes yet more imperative the necessity for further research, and the institution which contents itself with present knowledge will soon find itself forgotten."

One interesting result of the discussion of topics seemingly little related to agriculture was the revelation of numerous ways in which they are in reality closely associated. For example, in the animated discussion of the proposed initiation of Federal aid to research in engineering, one of the principal arguments advanced for the loca-

tion of the prospective stations at the land-grant institutions was the successful maintenance of corresponding stations for experimentation in agriculture. The belief was widely expressed that agriculture and the mechanic arts are not only vitally related, with many points of contact, but possess plentiful opportunities for mutual service.

Thus, Dean A. A. Potter of the Kansas College said, "The location of the proposed experiment stations at land-grant institutions will result in close cooperation between the engineering and the agricultural experiment stations. Such cooperation will prove beneficial to modern agriculture and will also result in the utilization of waste materials from the farms. The increased use of farm machinery and of farm motors on modern farms merits much engineering investigative work of direct benefit to the agricultural industry. Other engineering investigations, such as road building, rural architecture, drainage, and irrigation, can best be carried on at land-grant institutions, where the engineering experimenters can secure valuable aid from their colleagues in the agricultural experiment stations."

Even the authorization of the reserve officers' training corps in the land-grant colleges, under the provisions of the National Defense Act, was shown to have a bearing on the preparation of teachers and investigators in agriculture. The paper of Dean Edward Orton, jr., of the Ohio State University, pointed out that the establishment of these units will involve considerable reconstruction of courses, and he maintained that the theoretical military training prescribed can, in many cases, be obtained only by a replacement of other studies—cultural, scientific, or technical. While it is expected that the reserve officers will be developed more largely from students in engineering than in agriculture, there will none the less be some reconstruction of agricultural courses, and the problem will thus be presented of insuring that the fundamentals of a sound scientific and technical training be carefully conserved.

The relationship of home economics and agriculture have long been recognized, yet it remained for this convention to bring out the extent to which the comparatively new campaign for the betterment of the country home is going forward and to draw attention to some of its special problems. Practically an entire day was given to the subject, most of one morning's general session and the afternoon meeting of the section on extension work.

The general session devoted to home economics was opened with the report of the bibliographer, Dr. A. C. True of the States Relations Service, which dealt with published sources of information about farm women. This report was very suggestive in several ways. It included less than a dozen books, articles, and bulletins dealing exclusively with the subject, with about 150 other references to va-

rious phases. In assembling the material an extreme meagerness of investigational data, coupled with the frequent but superficial treatment of the subject in books on country life, rural education, and economy, a tendency to give much space to the experiences of individual country women, and the popularity of the farm woman as a subject of discussion among organizations representing a surprising variety of interests, were among the characteristics discovered.

An illuminating idea of the field still to be traversed by home economics writers was also afforded. In the words of the report, "problems have been worked out in individual cases and the results applied in practice, but as yet the economic, sociological, and psychological principles underlying this work have not been analyzed and formulated. Standards, such as are used in farm-management work, have not been worked out by surveys; accumulated practical experience has not been summed up and presented in a systematic way for the guidance of others."

This report should prove extremely helpful to home economics workers. As the quotation indicates, there is great need for fundamental studies in home economics analogous to the experimentation in agriculture. Yet in spite of the large amount of time allotted the subject on the program, this phase otherwise received only incidental mention, attention being concentrated almost wholly on the extension side of the work. A symposium was given before the general session on organization and administration under the Smith-Lever Act as related to the home economics departments and the farm home, while the sectional program dealt with home economics extension in its relations to women's work in the home, rural engineering and architecture, and rural health and personal hygiene, and a discussion of the function of the woman extension worker. These papers revealed in a most interesting way the many channels which are being developed to reach the farm home. It seems clear, however, that the need and opportunities for research would be an especially appropriate topic for future discussion in the new subsection of home economics, the establishment of which was authorized by the college section.

Extension problems in agriculture likewise attracted much attention. The standing committee on extension organization and policy submitted a carefully prepared report discussing the relationships between the colleges and the U. S. Department of Agriculture. The section of extension work considered two main topics, the use of the written project system and the holding of National conferences on extension projects. Extension relationships were also first among the topics discussed by Secretary Houston in his address before the as-

sociation, in which he expressed his appreciation of the spirit of cooperation evinced on the part of the States in the coordination of the agricultural activities of the Nation. Already, he stated, in spite of the difficulties inherent in inaugurating so large and complex an enterprise, the States are cooperating with the Federal Government far beyond the requirements of the law.

College instruction in agriculture was discussed from several points of view. The report of the standing committee on instruction in agriculture dealt with the question of college credit for high-school agriculture. This included a study of existing conditions, by Mr. D. J. Crosby, which indicated that agriculture is now accepted as an entrance subject in forty-four of the forty-eight States, but that only one institution allows advanced credit. It was found that agriculture is now taught in 19 per cent of the high schools of the country, and the committee considered this a factor which might well be taken into account in college instruction to a greater degree. Certain fundamental principles of agriculture, it pointed out, might be taught as effectively in the high schools as in the freshman class, or even better if the college instruction is delegated to fellows and assistants of limited years and experience.

Some obstacles, however, were recognized to the acceptance of high-school agriculture, especially the wide variation in the grade of work accomplished. Care is needed in the selection of textbooks and apparatus and the outlining of courses, and it was suggested that the colleges might here render a useful service. In twenty-eight States there is no systematic supervision of high-school instruction in agriculture. In some States the college and the State Board of Education cooperate, but it was believed that the efforts of the colleges in this field should be suggestive rather than arbitrary, and should scrupulously avoid the appearance of domination.

Methods of Improvement in Teaching College Agriculture were discussed by Dean W. W. Charters of the School of Education of the University of Missouri. Dean Charters pointed out that the important thing in education is not apparatus or buildings or equipment, but the classroom intercourse of teacher and student. He believed that the present teaching of agriculture is very uneven in quality. One difficulty is that the results of teaching are less tangible than those of research and therefore easy to judge in a comparative way. The code of professional ethics which bars instructors of equal rank from the classrooms of others also hinders improvements and obscures the merits of efficient teachers. More attention to the formulation and application of pedagogical principles of agricultural instruction was earnestly advocated. It is of interest to note that very

similar views were expressed in the section on engineering as regards instruction in that subject, and that close cooperation with schools of education was a suggested remedy.

Another way to increase efficiency in the colleges was proposed by President Waters, of Kansas, in a paper favoring an increase in the length of the college year. President Waters pointed out that under the present plan, the bulk of the enormous educational investment is idle almost one-third of the year, and he also maintained that this involves a great loss of time to the student. He summarized tests which indicated that the objection to summer study in warm climates is not valid, these tests indicating that mental efficiency, instead of being impaired by hot weather, steadily increases during the summer to a maximum in October or early November, and then declines to a minimum in midwinter. The ever-growing attendance at summer schools offering college credit was also cited as evidence that the customary vacation is longer than necessary, and that many students welcome the opportunity to hasten the completion of the period of preparation for their life work.

The employment of graduate students as research assistants in the station formed the subject of a joint meeting of the college and station sections. Director J. G. Lipman described the system carried on at the New Jersey Stations, where nine such assistants are now at work, and claimed advantages to both the station and the student. Graduate students as a class have been found to possess marked mental keenness and zest, and while not available for the working out of comprehensive projects can frequently be entrusted with certain important details, such as the compilation of bibliographies, the recording of results, and the tabulation of data, and even the handling of some minor problems like the study of a single soil organism or the effect of a method of treatment. In the discussion which followed the successful employment of graduate assistants was reported from several other stations.

A paper by Prof. L. R. Jones, of the University of Wisconsin, took up the same matter from the standpoint of the graduate student, considering especially some of the difficulties which might be encountered. Among these he mentioned the possibility of exploitation, the danger of attracting the weaker graduates, and the desirability of minimizing the risk of inbreeding. He maintained that a student ought not to be allowed to continue on such a basis year after year, especially at the same institution, but that even if it involved some temporary inconvenience to the station, he should, whenever his own well-being demanded it, be encouraged to "migrate" elsewhere. The fundamental consideration, therefore, in the

employment of this class of assistants should be their ultimate development as well prepared investigators.

The responsibility of the stations to present their results in a form available for popular use was emphasized in a paper by Director R. L. Watts, of Pennsylvania, entitled Shaping Results of Experiment Station Work for Extension Uses. This paper took the ground that the experimenter himself, who knows the results better than anyone else, should, as a rule, serve as the translator of technical work into popular form. He should, therefore, make a study of methods of presentation of results. Some of the principles to be observed were explained and illustrated by means of charts comparing the effectiveness of tables, graphs, maps, and the like. The use in the popular presentation of results of massive tables, poor photographs, complicated charts, and graphs of technical appearance was deprecated, while skillfully designed charts and graphs, good photographs, even if of small size, and condensed tables may be very effective.

Some general aspects of station publications were brought out in the ensuing discussion. The opinion was expressed that many bulletins need not be made so technical as to be beyond the comprehension of the farmer, and that others might be published in more than one form. There was general agreement as to a real danger of an overshadowing of the station by cutting off the staff from direct communication with the farming public. While it is true that the time of the research worker must be husbanded, he is none the less entitled to present his results directly and in his own way. Above all he should be safeguarded against any tendency by others to "play up" special features.

The important subject of the relations of the stations to regulatory work, concerning which the standing committee on experiment station organization and policy had submitted a report at the 1915 convention, had originally been assigned to the late Director Kastle, of Kentucky, and the paper presented in his stead by Dean A. F. Woods, of Minnesota, embodied some material collected by him. A considerable amount of data as to existing methods of handling regulatory work in the various States was summarized, but as an indicator of the desirable future policy the discussion as a whole was far from exhaustive.

There was considerable support of the view that with well managed state boards of agriculture, safeguarded by civil service regulations, the stations might well be relieved of police duties alien to their real purpose as research institutions, and that if the stations were to be expected to carry on such work they should organize it as independently as possible from their other work. It was some-

what unfortunate, however, that the lateness of the hour at which this topic was reached on the program tended to prevent a more complete discussion, and its reassignment at some subsequent meeting would seem to be amply justified.

A discussion on the Correlation of the Work of Experiment Stations in Regions with Similar Conditions was opened by Director J. C. Kendall, of New Hampshire, and participated in quite generally. Many possibilities of such correlation were pointed out, and instances cited of work already in progress. Some apprehension was expressed lest it result in an abridgment of the freedom of the individual investigator, and emphasis was laid on the individual factor in research. Others expressed the conviction that, at least in the simpler forms of inquiry, an understanding of what others in the same field are attempting might frequently enable individual workers or stations to coordinate and readjust their work to advantage. Thus, while certain types of duplication of work are not harmful and others may be beneficial as a corroboration of results, there are instances where mere repetition does not strengthen, as was intimated in the report of progress of the standing committee of the association on projects and correlation of research.

The meetings of the station section were unusually well attended, and the discussions as a whole were participated in by a large number of those present. The program was originally arranged for a single afternoon session, but in its consideration most of a second afternoon was eventually utilized.

The business of the association itself centered largely around the questions of the engineering experiment stations and the development of courses in military training. On the first of these propositions, the association reaffirmed its belief in the advantages of organizing enginering experiment stations, and declared that Federal aid for such stations should follow the lines of the Morrill Act and its supplementary legislation, irrespective of local conditions. The executive committee was empowered to represent the association in conference with other bodies interested in the formulation of such legislation.

The association expressed its interest and appreciation of the advantages of the proposed training corps sections of the National Defense Act, and manifested its desire to cooperate with the War Department in its practical application. The measure was discussed in detail by members of the association and Maj. Andrew Moses, of the War Department, in one of the general sessions, and provision

was also made for special conferences of those interested at that Department.

The report of the standing committee on graduate study described the work at the 1916 session at the Massachusetts Agricultural College and discussed the steadily decreasing attendance at these sessions. The decline was attributed in part to the large amount of summer work now being required of many members of college faculties, but even more directly to the increased facilities now available for systematic graduate study in agriculture and the fact that this instruction could be recognized by academic credit. During the past year 25 institutions registered at least 6 graduate students in agriculture, and the total was not far from 1,000. The committee recommended that, in view of these changing conditions, the 1918 session of the school be postponed for one year, and that the association consider at its next meeting the general question of the continuance of the school. This recommendation was accepted by the association.

Resolutions presented by a special committee on the death of Dr. J. H. Kastle were adopted by the association. These resolutions included a fitting tribute to Dr. Kastle, stating that in his death the association " has lost a valued member, the science of chemistry one of its most able investigators and teachers, agriculture an exponent of unusual breadth of view, and the scientific world in general a worker conspicuous for his tireless energy in the prosecution of its work and a master in the presentation of the results of his labor."

The next meeting of the association will probably be held in Massachusetts in October, 1917. An invitation was received to hold the sessions in Springfield, Massachusetts, with a one-day program at Amherst in connection with the celebration of the fiftieth anniversary of the opening of the Massachusetts Agricultural College. A vote of preference was given for this procedure, subject to alterations if deemed advisable by the executive committee.

The election of officers resulted in the selection of President K. L. Butterfield, of Massachusetts, as president; President C. A. Lory, of Colorado, President Brown Ayres, of Tennessee, Dean J. L. Coulter, of West Virginia, President C. A. Duniway, of Wyoming, and President W. B. Bizzell, of Texas, vice presidents; and the reelection of the previous secretary-treasurer and bibliographer. The membership of the various committees underwent few changes. President R. A. Pearson, of Iowa, succeeded President Ayres as a member of the executive committee, and Dean E. Davenport, of Illinois, replaced President Howard Edwards, of Rhode Island, as a member of the committee on graduate study.

The section officers included, in the college section, President C. C. Thach, of Alabama, chairman, and Dean A. F. Woods, of

Minnesota, secretary; in the station section, Dean R. S. Shaw, of Michigan, chairman, Dean W. M. Jardine, of Kansas, secretary, and Mr. W. H. Beal, of the States Relations Service, recording secretary; in the extension work section, Mr. R. K. Bliss, of Iowa, chairman, Mr. C. R. Titlow, of West Virginia, secretary, and Mr. C. B. Smith, of the States Relations Service, recording secretary; in the engineering section, President W. H. S. Demarest, of New Jersey, chairman, and Dean A. A. Potter, of Kansas, secretary; and in the home economics section, Miss Josephine T. Berry, of Minnesota, chairman, and Miss Helen Knowlton, of New Hampshire, secretary.

The 1916 convention was thus an interesting and important gathering, and though its dominant interests were not directly agricultural it was of much service in this direction. It emphasized, as perhaps no previous meeting has done, the essential solidarity of the component institutions, and revealed opportunities still existing for even more complete cooperation and mutual helpfulness.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

The chemical nature of the "vitamins."—I, Antineuritic properties of the hydroxypyridines, R. R. WILLIAMS (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 437–445*).—The author has prepared the following pyridine derivatives and tested their therapeutic action on polyneuritic pigeons by intramuscular injection of doses of from 1 to 10 mg.: Nicotinic, cinchomeric, quinolinic, 6-hydroxynicotinic and citrazinic acids, α-hydroxypyridine, glutazin, 2-, 4-, 6-trihydroxypyridine and its anhydrid, and 2-, 3-, 4-trihydroxypyridine and the so-called tetrahydroxypyridine.

Of these substances definite evidence of curative power was noted only in the case of α-hydroxy-, 2-, 4-, 6-trihydroxy-, and 2-, 3-, 4-trihydroxypyridine. The remainder of the series showed no effect whatever, although it is deemed that such negative evidence in the case of any hydroxy derivatives can not be regarded as conclusive. It was noted that all the cures obtained were of those pigeons which were treated with freshly prepared materials, while those treated with the same preparations a few days or weeks later invariably received no benefit. The substances were evidently changed in some manner so as to lose their curative power, although no deterioration was evident. The existence of a tautomerism in the hydroxypyridines suggested itself as being of some interest in this connection.

Following this suggestion it was found that a granular and a crystalline needle form of α-hydroxypyridine could be prepared, both of which melted sharply at from 106 to 107° C. After proper purification by remelting, keeping well above the melting-point temperature for some time, and then allowing to cool slowly, the mass was found to consist largely of needles. By recrystallization from benzene with ligroin it was sometimes possible to obtain the needles free from any granular crystals. On allowing the solid needle form to stand for a few days in an open vessel or cork-stoppered bottle it was observed that the crystals had undergone a change. The original clear and sharply defined needles were marked by transverse lines of cleavage. The rate of the change was variable but apparently depended on the amount of moisture in the atmosphere surrounding the crystals. Neither of these forms was found to absorb appreciable amounts of bromin instantaneously when titrated in the cold with alcoholic bromin, so that neither form could have been the hydroxy or enol form. On dissolving either form in an excess of alcoholic NaOH of known strength an instantaneous absorption of bromin in excess of that required by the alkali occurred.

"It appears that there exist not two but three isomeric forms of α-hydroxypyridine. . . . By simple means we may cause any desired form to predominate and may pass through the cycle repeatedly. Each exists in equilibrium with at least one other in relative quantities depending on conditions. We shall understand their relationships fully only after finding a method for determining each of the three forms quantitatively under varying conditions. At present we can measure only the amount of enol."

The results from tests made on pigeons with these forms of α-hydroxypyridine in general approximated very closely those obtained with hydrolyzed extract of rice polishings, both in rapidity and completeness of action of the paralytic symptoms. Boiling temperature destroyed the curative power of the needle form, and in solutions more than five or six days old it was no longer detectable.

The granular form obtained by prolonged standing of the needles was tested on a number of birds in various quantities and under various conditions, but in no case was there the slightest evidence of any benefit. "This absolute lack of curative properties is striking and suggestive. If the isomeric forms exist in equilibrium and there is fairly rapid transformation in any direction, one would suppose that the granular form would, when injected into the body, rapidly convert itself into the curative form as the latter was removed from solution by absorption in the tissues or fluids requiring it. That such is not the case suggests strongly that the pathological conditions of polyneuritis are not due to a deficiency of a substance per se, but to a lack of a certain type of potential energy which only certain substances can supply. In other words . . . it is the potentiality of isomeric change that produces the desired result. In this connection it is interesting to note that many purin and pyrimidin derivatives, some of which Funk [E. S. R., 27, p. 868; 29, p. 664] has reported to be partially curative for polyneuritis are also theoretically capable of a similar isomerism. That these substances are to a greater or less degree enol-keto tautomers is strongly indicated, by well-known reactions of uric acid for example. The existence of a third isomer is not excluded by theoretical considerations, but lacks the support of any considerable experimental evidence."

It is indicated that the antineuritic properties of these substances "suggest that an isomerism is at least partially responsible for the instability of vitamins in foodstuffs, and that the antineuritic property may be inherent in the potentiality of this type of isomerism. We may not conclude that vitamins are necessarily hydroxypyridines, since a similar isomerism may exist in substances containing other heterocyclic nitrogenous nuclei which are known to occur widely as constituents of animal tissue."

Separation and hydrolysis of albuminous substances from the seeds of Arachis hypogæa, I. S. I͡AICHNIKOV (JAINSCHNIKOW) (*Iz Rezul't. Veget. Opytov Lab. Rabot (Rec. Trav. Lab. Agron.), 9 (1913), pp. 378–385*).—Proteins from the seeds of *A. hypogæa* were extracted by means of water, 70 per cent alcohol, a 10 per cent solution of sodium chlorid, and a 0.25 per cent solution of potassium hydroxid. The total amount of nitrogen in the seeds was found to be 9.1 per cent, of which as much as 8.74 per cent occurred as albuminous substance, including albumin, glutin, and globulin. Glutin and globulin were hydrolyzed with the subsequent separation of histidin, arginin, and lysin. The work and the methods employed are described in detail.

The influence of alkali and alkaline earth salts upon the rate of solution of casein by sodium hydroxid, T. B. ROBERTSON and K. MIYAKE (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 351–361*).—Analytical data submitted show that "the presence of alkali or alkaline earth chlorids in the sodium hydroxid solutions employed as solvent . . . decreases the rate of solution of casein by dilute sodium hydroxid. The retardation increases with the concentration of salt employed. The alkaline earth chlorids in 5/1,000-normal concentration retard the rate of solution of casein approximately to the same extent as 100 times this concentration of a chlorid of an alkali." The amount of casein dissolved (X) is expressed by the formula $X=Kt^m$; K and m being constants and t expressing the time. The constants depend on the concentration and kind of alkaline solution employed as solvent.

On the mechanism of oxidase action, G. B. REED (*Bot. Gaz.*, *62* (*1916*), *No. 1, pp. 53–64, figs. 4*).—In connection with certain experiments the author has observed that different samples of colloidal platinum and silver (prepared by passing a direct current between two electrodes of the metal under water) behaved differently toward solutions of gum guaiac. The guaiac was in some cases oxidized directly, while in others only after the addition of a peroxid. This phenomenon suggested that samples of colloidal metal might contain different proportions of oxygen, and further that the amount might be varied by suitable treatment. The following experiments which prove the supposition to be correct are reported:

A large platinum crucible with a surface of about 150 sq. cm. (about 23.25 sq. in.) was platinized in the ordinary manner, by making it a cathode in a solution containing 2 gm. platinum chlorid and 0.16 gm. lead acetate in 60 cc. water, until the surface was uniformly coated with a black deposit of colloidal metal. It was then subjected to active hydrogen by making it a cathode in a dilute solution of hydrochloric acid. The crucible thus treated when placed in a solution of gum guaïac free from peroxid or any solution of potassium iodid produced no oxidation. After subjecting the colloidal metal to active oxygen, however, it produced rapid oxidation when placed in either of these solutions. Although the reaction took place rapidly it was observed that only a very small amount of material was oxidized.

To determine whether only sufficient oxygen for a limited oxidation was taken up by the platinum, the oxidation of formaldehyde to formic acid, which is catalyzed by platinum black and which can be accurately and conveniently measured, was undertaken. About 80 cc. of a solution containing 5/100-molar NaOH and approximately 3/10-molar formaldehyde was placed in an open beaker in a water bath maintained at a constant temperature of 30° C. The platinum crucible was freshly platinized, exposed to active oxygen for five minutes, and after being thoroughly washed introduced into the solution of formaldehyde. The mixture was kept thoroughly stirred throughout the experiment, and at frequent intervals 2 cc. portions were removed and titrated with 5/100-molar hydrochloric acid. The amount of NaOH neutralized by the formic acid generated in the reaction was thus obtained. The results are expressed graphically and support the supposition noted above.

Other experiments in a study of the mechanism of the oxidation of formaldehyde to formic acid with platinum as a catalyst are reported. The results show that in the oxidation of formaldehyde by hydrogen peroxid in the presence of platinum black the platinum combines with oxygen from the hydrogen peroxid as it combined with oxygen when subjected to anodic oxidation. This compound of platinum then gives up its oxygen to the formaldehyde, producing formic acid.

From the results in general it may be concluded that "when colloidal platinum is introduced into a mixture of hydrogen peroxid and an oxidizable substance the platinum takes up oxygen from the peroxid, thereby forming a more efficient oxidizing agent than the original hydrogen peroxid. The catalytic action of the platinum in this case, that is its peroxidase action, therefore depends upon its aptitude for forming unstable oxygen compounds when it is in contact with hydrogen peroxid."

Similar work with plant material is in progress.

The ferments of pineapple juice, H. FOUQUÉ (*Compt. Rend. Acad. Sci.* [*Paris*], *162* (*1916*), *No. 12, pp. 433–435*).—In the study reported the pineapple juice was expressed as aseptically as possible, received in sterile flasks, and allowed to ferment, some samples under anaerobic and others under aerobic

conditions. When the fermentation was complete nutrient gelatin was inoculated with the various fermented juices.

From the aerobic fermentations three organisms, which have been designated as *a*, *b*, and *c*, were isolated, and from the anaerobic fermentation the organisms *a* and *c* and another predominating form (*d*). In further experiments sterilized pineapple juice was inoculated with the various organisms isolated, and the speed and character of the fermentations observed.

The cultural and morphological characteristics of the organism *d* are described. Both it and the organism *b* belong to the genus Saccharomyces. The organisms *a* and *c* seem to be intermediate between the Mycoderma and the Torula.

The nature of the acid-soluble phosphorus of serum, I. Greenwald (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 431–435*).—Experimental data submitted indicate that the phosphorus compounds of serum consist almost exclusively of phospholipins and inorganic phosphate. The presence of a form which is insoluble in dilute acids but is not precipitated by magnesia mixture or molybdate solution was also indicated. This latter does not dialyze readily from the serum.

Factors influencing the lime and magnesia requirements of soils. A method for the determination of the immediate lime requirements, W. H. MacIntire (*Tennessee Sta. Bul. 115 (1916), pp. 5–48, figs. 2*).—A restatement and discussion of some of the data previously reported (E. S. R., 31, p. 815), with the addition of new material.

Analytical results secured in the determination of residual carbonates demonstrate the existence of a long-continued reaction between soils and carbonates. Such data emphasize the necessity of defining more specifically the term "lime requirement," and appear to necessitate a differentiation between temporary or immediate lime requirement and the continued propensity of a soil to decompose calcium carbonate when it continues in contact with excess carbonates. Whether the lime requirement of a soil should be considered as its maximum coefficient of calcium carbonate decomposition under laboratory conditions in a given time, or whether it should be considered as the amount of lime essential to maximum crop response for a definite period after treatment is an undecided question. "The feasible procedure would be to determine a method which would affect the maximum decomposition of $CaCO_3$ by its contact with the acid-reacting soil constituents under well-controlled laboratory conditions, and then, if possible, to establish a relationship between this maximum decomposition and practice."

Results from laboratory experiments on the decomposition of earth carbonates by sterile alkaline soils agree with the observations of Morse and Curry (E. S. R., 21, p. 713). Silicic acid was found to be a considerably stronger acid in its action on carbonates than has been hitherto supposed. "Where lime is added in amounts sufficient both to meet lime requirements and to insure an excess of carbonate, which would be the more subject to action of carbonated water, any calcium silicate resulting from treatment would probably remain largely as such. However, in presence of carbonated water the lime-silica reaction is readily reversed." Further observations show that the reaction between magnesium carbonate and silica and siliceous compounds is more extensive than that between these substances and calcium carbonate. The reversal of the magnesia-silica reaction through hydrolysis in the presence of carbon dioxid in solution was found to be correspondingly more difficult than that of the lime-silica compounds.

Further data presented demonstrate "that after the elimination of biological influences and the removal of organic and inorganic colloidal matter, we secure

a continued decomposition of earthy carbonates by alkaline soils under moist contact conditions at normal temperatures. This decomposition is shown to be very appreciable in the absence of any hydrated silicates."

The reaction of soil and calcium carbonate thrown out of carbonated water solution by agitation and suction and the effect of the period of contact of soil and $CaH_2(CO_3)_2$ solution before evaporation was also studied. The data obtained demonstrate that a great difference in time of contact in the laboratory affects in some degree the extent of the reaction between the carbonate and the soils.

It is indicated that " $MgCO_3$ will satisfy a soil's requirement for lime, but that the satisfying of a soil's requirement for lime by long continued contact with $CaCO_3$ does not inhibit the excessive decomposition of added $MgCO_3$ under laboratory treatment. Not only is this true of normal calcareous soils, but it is also true of soils which have been ignited with an excess of $CaCO_3$."

" The combined presence of calcium, sodium, and potassium carbonates is not necessarily inhibitory of the decomposition of the precipitated carbonate of magnesium."

A procedure for the determination of the immediate lime requirement of soils, in which a suitable sample of soil is evaporated with calcium carbonate solution and the excess carbon dioxid then determined according to the procedure previously noted (E. S. R., 30, p. 808), is described in detail, together with the procedure for preparing the calcium carbonate stock solution and a pressure container for the same. A convenient form of carbon dioxid generator is also described.

From a comparison of the proposed method with the procedure of Hutchinson and MacLennan (E. S. R., 32, p. 609), it is indicated that "not only does the Hutchinson-MacLennan method fail to produce the decompositions equivalent to those effected by the Veitch [E. S. R., 14, p. 418] or the proposed method, but the carbonated water solvent depresses the reaction and gives less carbonate decomposition than is effected by agitation with $CaCO_3$ in CO_2-free water for the same period at room temperature."

It is deemed that the conditions of the procedure described effect the complete satisfying of the temporary lime requirement of soils, and it is intended to supply a simple means which will permit the satisfying of the maximum immediate lime requirement of acid silicates and silicic acid, the principal causes of lime requirement in rock-derived soils.

The relation between laboratory and field lime requirements and the occurrence of soil acidity in field and laboratory experiments are briefly described.

A method for the determination of the immediate lime requirements of soils, W. H. MacIntire (*Jour. Indus. and Engin. Chem., 7 (1915), No. 10, pp. 864–867, figs. 2*).—The method described, together with the procedure for preparing and standardizing the calcium carbonate solution, a pressure container for the same, and a modified form of carbon dioxid generator are noted above.

Lime and magnesia in New Zealand soils, B. C. Aston (*Jour. Agr. [New Zeal.], 12 (1916), No. 1, pp. 47–54*).—Analyses of 366 samples of New Zealand soil showing the calcium and magnesium oxid contents as extracted by hydrochloric acid and by 1 per cent citric acid are reported, the results of which indicate that the lime content of these soils is relatively low. " When soils which are known to be sterile owing to the excess of magnesia, when the magnesia is present in quantities ten times as great as the lime, both weak and strong solvents indicate that the magnesia is in excess. . . .

" Soil which will grow forest, although showing a greater amount of magnesia than lime by the hydrochloric-acid method, shows a greater amount of lime than magnesia by the 1 per cent citric-acid method of extraction, whereas

the soil which will only grow scrub shows more magnesia than lime by both methods, as, similarly, does the soil which will not grow anything." It is indicated that "it may be ultimately found . . . that the 1 per cent citric-acid method . . . may prove a means of diagnosing an injurious excess of magnesia in soils."

A rapid method for the estimation of calcium oxid in peat soils, R. A. Gortner (*Soil Sci., 1 (1916), No. 5, pp. 505–508*).—In connection with some work on peat soils at the Minnesota Experiment Station the author devised the following procedure for the determination of calcium in peat:

Five gm. of peat is incinerated in a quartz dish, the ash digested with aqua regia, evaporated to dryness to dehydrate the silica, the residue taken up with dilute acid, filtered into a 500 cc. flask, and made to volume. To 100 cc. of this solution enough ammonia is added to make the liquid smell strongly and to precipitate the iron and aluminum. The liquid is brought to a boil, and while boiling 10 cc. of a saturated solution of ammonium oxalate is added. The calcium oxalate is thus precipitated over the surface of the iron hydroxid, making the latter more or less granular, and greatly aiding filtration and washing. The boiling is cautiously continued for a few minutes and the solution allowed to cool.

After at least three hours, or preferably overnight, the solution is filtered and well washed with warm water. When the precipitate is completely washed, the beaker in which the precipitation was made is placed under the funnel, a hole punched in the filter paper, and the precipitate washed into the beaker with a stream of warm water. The filter is then well washed with a hot 1.5 per cent sulphuric acid solution, 10 cc. of concentrated sulphuric acid is added to the washings, the solution brought nearly to a boil, and the oxalate titrated with a standard potassium permanganate solution of such strength that each cubic centimeter is equivalent to 0.001 gm. of calcium oxid.

Analytical data submitted indicate the accuracy of the procedure. The method is not applicable to mineral soils, the results being consistently high.

A rapid method for the estimation of fat in powders, S. B. Phillips (*Analyst, 41 (1916), No. 482, pp. 122, 123, fig. 1*).—The author describes a specially devised apparatus for use in the estimation of fat in powders, using trichlorethylene as a solvent. The method is similar in principle to the procedure described by Neumann (E. S. R., 26, p. 507) and is claimed to yield excellent results.

The determination of sucrose in cane products by direct polarization, using a new method for the destruction of the reducing sugars, C. Muller (*Internat. Sugar Jour., 18 (1916), No. 210, pp. 274, 275*).—For the destruction of reducing sugars in the determination of sucrose in cane products by direct polarization the author describes the following procedure:

A reagent is prepared by dissolving 25 gm. of Rochelle salt and 32 gm. of sodium hydroxid in 400 cc. of distilled water. To this, after heating slightly to effect solution, is added 11 gm. of bismuth subnitrate, heating being continued to dissolve the salt, after which the solution is cooled, made up to 500 cc., mixed, and filtered.

To use this reagent for the destruction of reducing sugars in the case of a cane molasses 20 gm. is diluted with 40 cc. of boiling water, 10 cc. portions of this dilution being poured on the weighed sample at a time, or 50 cc. of a solution containing 20 gm. of the molasses may be used. The liquid is placed in a 300 cc. flask, 15 cc. of the bismuth reagent added, and the mixture heated in a boiling water bath for 15 minutes. The liquid is then cooled, 150 cc. of cold water and the equivalent of 60 cc. of basic lead acetate of the density of

36° B. added, the volume made up to 300 cc., and the liquid mixed and filtered. It is now polarized by introducing 100 cc. into a 100–110 cc. flask, adding 5 cc. of acetic acid and sufficient water to reach the upper mark, treating with 2 gm. of special dry decolorizing carbon, mixing, and filtering, the observation being made in the 400 mm. tube.

It is indicated that the method is simple, rapid, and certain. "It is . . . applicable to all cane-sugar factory products, but not to special products such as those of the beet-sugar factory containing glutamic and aspartic substances, the optical activity of which is not destroyed by the bismuth reagent."

The determination of essences in liqueurs, X. ROCQUES (*Ann. Falsif., 9 (1916), No. 90–91, pp. 127–134*).—These pages report the findings of the committee appointed to investigate methods for the determination of volatile oils in liqueurs, necessitated by the recent legislation in France which ruled that not more than 0.5 gm. of oil be used in 1 liter of liqueur.

The volumetric method of Ronnet and the gravimetric method of Muttelet, both previously noted (E. S. R., 35, p. 111), are recommended as being satisfactory for the control of the purity of these products. The methods are described in detail and comparative analytical data submitted.

Manual for the essence industry, E. WALTER (*New York: John Wiley & Sons, Inc., 1916, pp. III+427, figs. 37*).—This volume describes the most modern methods for preparing all kinds of essences for liquors, brandies, liqueurs, and all alcoholic drinks, fruit juices, fruit wines, and mineral waters, together with many other valuable formulas. Other topics considered are the taste and the transfer of flavor to foods and beverages; the raw materials yielding the different tastes; confectionery, bakery, and culinary essences; coloring matters for foods and drinks; and cosmetic essences (perfumery, cosmetics, and soap perfumes). A chapter on laboratory practice, consisting of general manufacturing and analytical methods, is included, and a complete subject index is appended.

Canning in glass by the cold pack method, BAB BELL and ADDIE D. ROOT (*Univ. Missouri Col. Agr. Ext. Serv. Circ. 9 (1916), pp. 12, figs. 6*).—This circular briefly discusses the subject under the following heads: Why fruits and vegetables spoil; types of canners which may be used; and jars, tops, and rubbers. Directions for canning various fruits and vegetables are outlined in detail.

Some possibilities for the utilization of low-grade and surplus fruit, J. S. CALDWELL (*Washington Sta. Popular Bul. 102 (1916), pp. 4*).—This briefly summarizes the material previously noted (E. S. R., 35, p. 418).

Single-variety ciders and perry, 1913–14, B. T. P. BARKER and O. GROVE (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1914, pp. 11–21*).—These pages record analytical data on a number of single-variety ciders and a perry made from fruit collected during the season of 1913, together with remarks on the general character of the products. The analytical data include specific gravity, malic acid and tannin content, weight of fruit, yield of juice, and variations in the specific gravity after fermentation and bottling.

The treatment of cider sickness, O. GROVE (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1914, pp. 22–24*).—Experimental data have demonstrated that cider sickness can be remedied or prevented by either of the following methods: (1) Increasing the acidity, either by mixing a cider of low acidity with one which is naturally high or by adding a sufficient amount of tartaric acid, equivalent to about 0.5 per cent malic acid; or (2) the use of brewer's or compressed yeast. Increasing the acidity has yielded the most desirable results.

The use of sulphur dioxid and aeration yielded negative results.

The relative value of cane and beet sugar for fermentation purposes, O. GROVE (*Univ. Bristol, Ann. Rpt. Agr. and Hort. Research Sta., 1914, pp. 32, 33*).—In fermentation tests beet sugar was found to yield better results than cane sugar.

"Leaving out of consideration that most of the samples sweetened with cane sugar did not keep, but were attacked by a bacterial disease, whereas all the beet-sugar samples remained in good condition, the flavor of the cane-sugar samples was in all cases inferior. . . . That is, the peculiar taste of cane sugar was easily detected, whereas the beet sugar did not give any new flavor to the cider, but simply acted as a neutral sweetener, which, of course, is preferable. This result, being somewhat contrary to previously accepted views, . . . needs further confirmation by fresh experiments before much importance can be attached to it."

The fermentation of cane molasses; composition of rum, KAYSER (*Ann. Falsif., 9 (1916), No. 90–91, pp. 121–127*).—This article indicates the importance of the apparatus and method used in the distillation of rum as affecting its quality, and submits analytical data of a number of samples of rum fermented under varying degrees of acidity, with the use of 3 per cent ammonium fluorid, in the presence of both an abundant and a limited supply of air, and with various yeasts.

On the transformation of the nitrogenous substances during the forced curing of tobacco, L. BERNARDINI (*Ann. R. Scuola Sup. Agr. Portici, 2. ser., 12 (1914), pp. 347–359*).—It was found that in the forced curing of tobacco there is no appreciable destruction of protein substances, nicotin, or ammonia. There is, however, a loss of total soluble nitrogen which is apparently due to a loss of amino acids. An oxidation which converts a part of the insoluble nitrogenous substance to a soluble form is also apparent, and may in some degree account for the loss noted.

It is indicated that, while the results submitted do not exclude the fermentation theory of tobacco curing, it appears that the process is nevertheless to a large extent purely chemical.

Note on the detection of faulty sizing in high-grade papers, C. F. SAMMET (*Jour. Indus. and Engin. Chem., 8 (1916), No. 5, p. 476*).

METEOROLOGY.

Meteorology in relation to agriculture in Canada, R. W. STUPART and R. W. MILLS (*Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 2, pp. 177–179*).—This article explains briefly what the Meteorological Service of Canada is now doing and plans to do along this line, containing practically the same information noted from another source (E. S. R., 35, p. 15).

Meteorological observations, F. EREDIA (*Agr. Colon. [Italy], 10 (1916), I, Nos. 1–2, pp. 35–79, pls. 6, figs. 17; 3, pp. 131–150, pls. 4, figs. 13; 4, pp. 190–212, pls. 4, figs. 12; 5, pp. 239–266, pls. 3, figs. 10; 6, pp. 309–322, pl. 1, figs. 6; II, No. 7, pp. 245–280, pls. 2, figs. 10*).—This article describes the construction, installation, and operation of meteorological instruments suitable for observations in the Italian colonial possessions.

The frequency of low temperatures at Vercelli (Italy) and its effect on the cultivation of rice, B. MARCARELLI (*Gior. Risicolt., 5 (1915), No. 22, pp. 355–360, fig. 1; abs. in Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 2, pp. 192, 193*).—It was found that the minimum temperature limits are of great importance in the early stages of the growth of rice, this minimum limit being from 46 to 50° F. The maximum rate of growth was

found to be associated with a high minimum temperature, accompanied by warm, short nights. The highest minimum temperatures occur in Italy in July and the first week in August, when the humidity of the air is relatively high and the days long and very warm. Low temperatures during the last days of July and the first of September occurring at the important and tender stages of heading, inflorescence, and formation of grain caused considerable damage to rice in 1915.

Night frost in the East Indies, W. VAN BEMMELEN (*Tijdschr. Nijv. Landb. Nederland. Indië, 92 (1916), No. 2, pp. 126–131*).—The conditions under which these frosts occur are briefly discussed.

The weather of Scotland in 1915, A. WATT (*Trans. Highland and Agr. Soc. Scot., 5. ser., 28 (1916), pp. 242–256*).—The weather conditions for each month are summarized and much detailed data for rainfall at various places in Scotland are given.

It is stated that in the extreme north and in the western and most southern districts there was a well-defined shortage of rainfall, and toward the northwest the shortage was of a most decided character. "In West Inverness-shire the year was the driest on record. At Fort William the rainfall was 30 per cent below the normal, and three-fifths of it was accounted for before the end of April; every month from May onward had a shortage; and May, June, September, October, and November had each less than half the average amount of rain. Outside the northwestern area the extreme southwest appears to have been the region most notable for the persistence of dry periods.

"The severe frost of November seriously interfered with agricultural operations."

[The climate of Pavlovsk], A. V. SHIPCHINSKIĬ (A. SHIPCHINSKI) (*Zap. Selsk. Khoz. Inst. Imp. Petra I (Mem. Inst. Agron. Emp. Pierre I), 1 (1916), pp. 52–69*).—This is a summary of ten years' observations (1897–1904 and 1911–1913). The average annual temperature was 6.9° C. (44.4° F.), the precipitation 500.3 mm. (19.7 in.). The prevailing wind was southeast.

SOILS—FERTILIZERS.

Michigan's shifting sands: Their control and better utilization, F. H. SANFORD (*Michigan Sta. Spec. Bul. 79 (1916), pp. 31, figs. 23*).—This bulletin deals with the control and better utilization of about 534,000 acres of dune-formed land bordering on the Great Lakes in Michigan.

"The sand dunes in Michigan are found in four belts on the shores of the three greater lakes. These belts are the Superior Belt, the line of dunes found on the Superior shore of the Upper Peninsula; the South Shore Belt, the belt along the south coast of the Upper Peninsular; the West Shore Belt, that formed by the winds and waters of Lake Michigan upon the west coast of the Lower Peninsula; and the fourth, the East Shore Belt, that washed by the waters of Lake Huron. Geologically the sand dunes are young."

It is concluded that "sand along the Michigan shores can be controlled if proper methods are applied. Certain plants are admirably adapted for use in establishing a 'crust' in which other forms of tree growth must be planted to insure permanent forest cover. By waiting for planted belts to grow into high shelters, certain adjacent belts in the lee may be utilized by the growth of certain forest crops, or orchards, but never by annual crops.

"Studies of planting done from 10 to 20 years ago point out the imperative need of establishing and maintaining a solid cover on the windward slopes of all blows. Planting must begin on the windward side of a blow with the establishment of a facing of low forms that are capable of withstanding the rough treatment to which they will be subjected. In all dune formations where the sand is

cast up by water a control shelter of hardy shrubs must be set as close as possible to the winter line of high water and ice. An artificial barrier of drift material and wood forms a splendid protection and justifies considerable expense to establish it. . . .

"There are two general plans of operation in the work of sand control. The 'shelter belt' or 'barrier' system is suitable to private owners. It may be so managed as to enable the man of limited means to do systematically a portion of the work each year until the whole blow area is under permanent forest cover. The 'entire cover' system calls for heavy expenditure in labor and materials but has as its aim the completion of the work over the whole area in a single season."

Contribution to the knowledge of the weathering of podzol soils of middle Norrland, O. TAMM (*Bul. Geol. Inst. Univ. Upsala, 13 (1914–15), I, pp. 183–204, figs. 2; abs. in Chem. Abs., 10 (1916), No. 9, pp. 1243, 1244*).—Studies of samples of eight profiles of podzol soils in middle Norrland, Sweden, are reported.

The chemical composition of unweathered soils in the region, with perhaps the exception of clay, appeared to be very uniform. The chemical and mineralogical compositions of soil layers weathered by raw humus acids (bleicherde) were very uniform. The chemical processes involved in raw humus weathering of soils were found to consist of decomposition rather than transformation of the minerals. Apatite and dark colored minerals, such as biotite and hornblende, were the most easily soluble. On the other hand, feldspars were relatively little attacked. A marked formation of kaolin was not observed in cases where the feldspars had been relatively much attacked. An estimate of the amount of change in the original materials brought about by the formation of bleicherde showed that approximately 7.5 per cent of the bases in percentage of original material were dissolved.

A list of 11 references to literature bearing on the subject is appended.

Some problems of the study of forest soils, G. A. R. BORGHESANI (*Internat. Mitt. Bodenk., 5 (1915), No. 3, pp. 225–231, fig. 1*).—This is a critical review of the question of forest soils, with particular reference to the useful adaptation of tree kinds to different soils and the function of the covering of forest litter in the maintenance of forest soils. A list of references to literature bearing on the subject is appended.

Chemical and biological notes on cherry orchard soils, A. HARVEY and C. H. HOOPER (*Gard. Chron., 3. ser., 57 (1915), No. 1484, pp. 308, 309; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 8, p. 1067; Chem. Abs., 10 (1916), No 9, p. 1243*).—Chemical and mechanical analyses of several samples of orchard soils to determine whether the yield of cherries is a question of chemical and mechanical composition or one of pollination are reported, the results of which are taken to indicate "that very little value can be assigned to figures obtained either in the chemical or mechanical analysis. . . .

"The conclusions to be drawn from observations on the growth and cropping capacity of the cherry trees compared with the analysis of the soils would seem to be that favorable soil influences the actual growth of the tree, but not necessarily its fruiting capacity. The cherry being by nature a free flowering tree, if year by year it does not crop the fault is probably the lack of suitable cross-pollination rather than some fault in the soil."

Investigations on tobacco soils, B. T. P. BARKER (*Jour. Bath and West and South Counties Soc., 5. ser., 9 (1914–15), pp. 129–131*).—Analyses of a series of samples of American and African tobacco soils are reported.

"The American soils as a group may be described as very coarse-grained sandy soils of feeble water-holding capacity and poor in all the elements of plant food. . . . The African soils, on the other hand, are sandy soils of good

water-holding capacity (on account of the high percentage of organic matter) and well supplied with all the elements of plant food. . . . Compared with the American soils, the African soils (1) are much darker in color, (2) contain much more organic matter (humus) and nitrogen, (3) contain more phosphoric acid and potash, and (4) contain rather more of the finer grades of soil particles. It appears probable that these American and African samples differ essentially in that in the one case the plant food (especially the nitrogen) must be supplied in the form of readily available artificial manures while in the other it can be obtained, in somewhat different form, from the natural reserves of the soil. Therefore, even if the possible effect of differing climates and rainfall is set aside, there are many points of difference between the two groups of soils, any one of which may have an important influence on the quality of the crop."

Red soil, P. V. DE REGNY (*Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 9, pp. 1133–1138*).—The author reviews work by himself and others bearing on the subject and reports analyses of Karstian red soils from various localities.

It is concluded "that there are similar but not identical types of red soil and that they may have various origins; in nature the same effect is not always produced by the same cause. There are, therefore, red soils of different compositions, more or less ferruginous, or calcareous, or rich in alumina, produced either by direct or by indirect weathering of the limestone or by æolian action. . . . Red soils, at least in their most typical manifestations, must be considered as of a prevailingly colloidal type of formation."

Analyses of soils of Stewart County, W. A. WORSHAM, JR., L. M. CARTER, D. D. LONG, and M. W. LOWRY (*Bul. Ga. State Col. Agr., No. 99 (1915), pp. 59, figs. 4*).—This bulletin reports general soil survey data of the county, much of which has been previously noted from another source (E. S. R., 34, p. 120), and contains chemical analyses of each soil type mapped, together with a summary of the average of analyses for each type. "Taking the average of all the soils of the county, the analyses show the plant food content to be as follows: Nitrogen 0.025, phosphoric acid 0.045, and potash 0.508 per cent." These results are taken to indicate that nitrogen is the limiting factor of crop production in the county.

Notes on some west country soils, C. T. GIMINGHAM (*Jour. Bath and West and South. Counties Soc., 5. ser., 9 (1914–15), pp. 51–61*).—The author discusses the physical properties and formation of soils and describes the soils, especially of Gloucestershire, Somerset, and Wiltshire, England, with reference to their relationship to the geological strata underlying them.

A new method for mechanical soil analysis, S. ODÉN (*Internat. Mitt. Bodenk., 5 (1915), No. 4, pp. 257–311, figs. 15; abs. in Ztschr. Angew. Chem., 28 (1915), No. 77, Referatenteil, pp. 486, 487*).—A method is described which is based on the rate of sedimentation of the particles of a water suspension of soil as measured by the rate of the increase in weight of the settled matter. Preliminary experiments with the method are also reported. It is thought that this method may be useful in analysis of soils with slight variations in the size of particles of different strata or for saving time in the ordinary analysis. The apparatus used is also described and illustrated.

Judging soils on the basis of the hydrochloric acid extract and process of exchange of bases, A. A. J. VON SIGMOND (*Internat. Mitt. Bodenk., 5 (1925), No. 3, pp. 165–224, figs. 2; abs. in Chem. Abs., 10 (1916), No. 1, p. 80*).—It was found that detailed chemical analyses of hydrochloric acid extracts of soils gave characteristic comparative values as to the soil-forming factors which could not be obtained by lump analyses.

It is thought that instructive conclusions may be drawn from the process of base exchange in soils regarding soil-forming factors and also the physical and chemical soil properties.

The cause and nature of soil acidity with special regard to colloids and adsorption, E. Truog (*Jour. Phys. Chem., 20 (1916), No. 6, pp. 457–484; abs. in Chem. Abs., 10 (1916), No. 18, p. 2381*).—This is a review of a large amount of literature bearing on the subject and a general summary of the results of the laboratory research work on the subject at the Wisconsin Experiment Station.

It is maintained that the existence of selective adsorption of ions from the common alkali and alkaline earth salts is questionable. "The phenomenon observed in acid soils and often designated as selective adsorption of ions is of an entirely higher order in extent, and comparable in every way to chemical reactions between acids, bases, etc. . . . It is shown that, when the conditions are properly controlled, it can be demonstrated that the reactions due to soil acidity take place according to chemical equivalence and exhibit all the properties of true chemical reactions.

"The possibilities for the formation of true acid substances in soils of the humid region are manifold and it would be extremely difficult to explain why such substances should not be formed. In most upland soils mineral acids, i. e., kaolinite and other acid silicates, are the main cause of soil acidity. Soils high in organic matter may contain considerable amounts of organic acids. These acid substances may be either in the crystalloidal or colloidal condition and their acid reaction is due to their chemical nature and not colloidal condition."

Preliminary studies on heated soils, J. Johnson (*Science, n. ser., 43 (1916), No. 1108, pp. 434, 435*).—The results of experiments conducted at the University of Wisconsin are reported. It was attempted mainly to correlate the chemical changes produced in heated soils with their effect upon seed germination and plant growth. The conclusions drawn are considered to apply particularly to soils heated above 100° C. Various seeds were used, especial use being made of cabbage.

"The results in general were similar for the different seeds, though they varied much in their susceptibility to the injurious action. Lettuce and clover seeds were very susceptible to the injurious action of highly heated soils, whereas rye and buckwheat were very resistant. Plant growth is affected in much the same manner, wheat, for example, recovering rapidly from the deleterious action of certain heated soils where tomatoes appeared to be permanently injured.

"Different soils give markedly different results upon heating to the same temperatures. The action appears to be dependent particularly upon the content of organic matter in the heated soil. . . .

"The temperature to which the soil is heated is seemingly the most important factor in determining the extent of the injurious or beneficial action. Approximately 250° was found to be the most critical temperature in all the soils used. At this temperature seed germination was most strikingly retarded. Early plant growth was usually checked for the longest period of time on soils heated to 250°, although late plant growth, in the case of some crops at least, was most vigorous on these soils. Heating to temperatures of 300°, or above, in all the soils used again reduced the injurious action to seed germination and early plant growth, as well as the beneficial action to late plant growth. Heating soils to 250° produced greater amounts of material extractable with water than heating to higher or lower temperatures. The ammonia content of the soil increased proportionally to the temperature of heating up

to about 250°, after which it rapidly fell to a minimum. The increase in ammonia was accompanied by a decrease in nitrates, which were practically nonexistent in the highly heated soils. . . .

"The percentage of seed germination has been found to be closely correlated with the amount of ammonia present in the heated soils studied. The amount of ammonia required to injure germination, however, appears to vary with the type of soil when comparisons of different heated soils are made. It appears that the absorptive power of the soil is a very important limiting factor in determining the extent of the injurious action.

"The presence of dihydroxystearic acid . . . could not be demonstrated in the most toxic of the heated soils. That the toxic substance is of a volatile nature is evidenced by the fact that it is readily removed from the soil by aeration. . . . The evidence at hand points toward the formation and injurious action of ammonium carbonates particularly. These salts being unstable in the soil, except when kept in a dry and unaerated condition, accounts for the gradual disappearance of the injurious action of heated soils. It also appears that other compounds of ammonia are formed which are more stable in character. The beneficial action of heated soils on plant growth, especially of those heated between 150 and 250°, is believed to be due in a large part to the direct assimilation of ammonia or ammonium compounds by the plants."

Changes in soils brought about by heating, Miss A. Wilson (*Notes Bot. School Trinity Col. Dublin, 2 (1916), No. 6, pp. 311–318, figs. 3*).—The substance of this article has been noted from another source (E. S. R., 34, p. 722).

The occurrence of bacteria in frozen soil, E. C. Harder (*Bot. Gaz., 61 (1916), No. 6, pp. 507–517, figs. 2*).—Experiments conducted at the University of Wisconsin with field and potted soil to determine the effect of cold and moisture on bacterial numbers are reported.

It was found that "the number of bacteria in surface soil increased markedly after heavy frosts and in general maintained a high average during the winter months. The increases and decreases, however, were found to bear a distinct relation to the moisture content. The potted soils failed to show such marked increase in bacterial content after frosts. On the contrary, the enriched cultures showed a distinct retardation of bacterial growth when in a frozen condition. The bacterial flora was more or less the same during the fall, winter, and spring, with the exception that after heavy frosts the small transparent colonies characteristic of water and of deeper soils formed a larger proportion of the growth on the plates.

"From these results it seems reasonable to conclude that ordinary soil bacteria undoubtedly withstand cold to a marked degree, even to temperatures as low as 4° C. or more below zero. The increase in numbers, however, seems to be due to mechanical transportation by moisture coming up from below during heavy frost, and where such transportation is not possible there is an actual retardation in growth as compared with that in unfrozen soils."

Soil bacteria and phosphates, C. G. Hopkins and A. L. Whiting (*Illinois Sta. Bul. 190 (1916), pp. 393–406*).—A general review of present knowledge of the subject is given, together with the results of experiments on the solution of rock phosphate by nitrite and nitrate forming bacteria.

It was found that "nitrite bacteria make phosphorus and calcium soluble from insoluble phosphates when they oxidize ammonia into nitrite. The actual ratio found shows that about 1 lb. of phosphorus and about 2 lbs. of calcium are made soluble for each pound of nitrogen oxidized, aside from the action of the acid radicles associated with the ammonia. . . . Neither ammonia-producing

bacteria nor nitrate bacteria liberate appreciable amounts of soluble phosphorus from insoluble phosphates."

It is pointed out that "plants are important factors in the liberation of phosphorus, owing to the production of carbon dioxid and the removal of the soluble phosphorus produced by the bacteria. . . . Other acid-producing bacteria make phosphorus soluble from insoluble phosphates according to the nature and amount of the acid produced. A comparison of the amounts of nitrogen, phosphorus, and calcium required by farm crops, with those possible of solution by biochemical action, shows possibilities far beyond the plant requirements, which leads to the conclusion that plenty of rock phosphate in contact with decaying organic matter must give the plants an excellent opportunity to obtain both phosphorus and calcium as well as nitrogen."

Disinfection experiments on moor soil, A. von Nostitz (*Landw. Jahrb., 48 (1915), No. 4, pp. 587–606, pl. 1, figs. 3; abs. in Ztschr. Angew. Chem., 29 (1916), No. 16, Referatenteil, p. 98; Chem. Zentbl., 1916, I, No. 3, p. 115*).—Experiments with upland moor soils on the influence of carbolineum, calcium chlorid, and potassium permanganate when used as soil disinfectants are reported. Carbolineum was found to give better results than calcium chlorid.

The use of the disinfectants was accompanied by marked increases in crop yield, especially in the case of carbolineum. Carbolineum gave better results the earlier it was used before seeding and gave the best results when used at the rate of from 50 to 60 gm. per square meter of soil. Carbolineum rich in volatile constituents was more effective than when poor in these constituents. The action of carbolineum was especially marked with reference to its influence on the bacteria and nematode contents of soil.

Niter spots, W. Stalder (*Science, n. ser., 43 (1916), No. 1116, pp. 712, 713*).—The author refers to the theories of Sackett and of Stewart and Peterson regarding the origin of brown niter spots in arid soils (E. S. R., 25, p. 815; 33, p. 121), and reports his observations on niter spots in northwestern Nevada, which showed that the feces of jack rabbits when coming in contact with alkali water or moist alkali soil decomposed comparatively rapidly, forming brown spots containing nitrates. It is concluded "that the brown niter spots of the playas were, as far as examined, of animal origin. From these observations it is safe to predict that in fields of the arid western States brown niter spots will appear when live stock is pastured in the same and alkaline waters are used for irrigation."

Acid phosphate versus raw rock phosphate as fertilizer, A. T. Wiancko and S. D. Conner (*Indiana Sta. Bul. 187 (1916), pp. 1055–1082 fig. 1*).—This bulletin reports the results of 82 comparative tests of acid phosphate and raw rock phosphate which have been made by the Indiana Station since 1904. Series of tests covering varying lengths of time, but an average of 3.47 years, are reported, which "are believed to give a fair comparison of the use of the two phosphates under average Indiana field conditions with various crops and during different seasons on a large number of soil types." The crops grown included rotations of corn, wheat, and clover or soy beans, and potatoes and soy beans. The applications of acid phosphate varied from 150 to 500 lbs. per acre, averaging 205 lbs. and were valued at $16 per ton; of the rock phosphate from 350 lbs. to 1 ton, averaging 545 lbs. and valued at $7.50 per ton. The phosphates were used alone and combined with manure and were supplemented by applications of limestone when liming of the soil was deemed necessary.

The results are summarized in the following table:

Summary of 82 comparative tests of acid phosphate and rock phosphate on different crops and soils.

Crop.	Number of tests.	Kind of phosphate.	Averages per acre per year.					
			Yield.	Increase.	Value of increase.[1]	Phosphate used.	Cost of phosphate.	Profit or loss.
			Bushels.	*Bushels.*		*Pounds.*		
Corn	36	Acid phosphate	43.04	5.49	$2.95	190.5	$1.52	$1.43
		Raw rock	42.20	4.65	2.52	532.0	1.86	.66
		None	37.55					
Wheat	33	Acid phosphate	15.28	4.31	4.63	190.5	1.52	3.11
		Raw rock	12.88	1.91	2.12	532.0	1.86	.26
		None	10.97					
			Pounds.	*Pounds.*				
Legume hay	9	Acid phosphate	2,998	320	1.60	190.5	1.52	.08
		Raw rock	2,773	95	.47	532.0	1.86	−1.39
		None	2,678					
			Bushels.	*Bushels.*				
Potatoes	4	Acid phosphate	112.0	29.4	14.70	500	4.00	10.70
		Raw rock	94.2	11.6	5.80	1,000	3.50	2.30
		None	82.6					
Average	82	Acid phosphate			4.06	205	1.64	2.42
		Raw rock			2.29	545	1.91	.38

[1] Value of increase includes value of corn stover and wheat straw.

It is estimated from the average results that the profit per dollar invested was over seven times as great from acid phosphate as from rock phosphate. The value of the crop increase per pound of phosphorus applied was 28⅓ cts. for acid phosphate and 3.5 cts. for rock phosphate.

Red soils and phosphatic manuring, J. Arié (*Bol. Agr.* [*São Paulo*], *15. ser., No. 6–7* (*1914*), *pp. 535–555, figs. 2; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6* (*1915*), *No. 8, pp. 1042–1044*).—This report deals with the problem of manuring red soils, especially those of the State of São Paulo, Brazil, derived from the decomposition of diabasic rocks.

A series of analyses of these soils showed "that out of 48 samples, 4 contained only traces of phosphoric acid, 12 up to 0.5 [parts] per thousand, 15 from 0.5 up to 1 per thousand, 10 from 1 up to 1.5 per thousand, 6 others up to 3.6, and 1 even 5.2 per thousand. Humus is relatively low, from a minimum of 0.24 per cent up to 2.56 per cent exceptionally, but generally about 1 per cent. The lime content varies from 0.01 to 0.65 per cent. From these data and from other analyses . . . it appears that 60 per cent of the soils examined were in urgent need of phosphatic manuring. . . .

"Experiments were also made in order to determine the absorptive capacity of red soils for phosphoric acid, solutions of monocalcium phosphate being placed in contact with the soil samples." It was found that the phosphoric acid was almost entirely absorbed after 20 days of contact, but this absorption was accompanied by an insolubility and consequent retrogression of the phosphate.

"The most important factors in this fixing of phosphoric acid are lime and humus. When a more calcareous red soil was taken 0.22572 gm. was absorbed at the end of 20 days instead of 0.214608 gm. Humus contributes to regulate the absorption, but . . . it serves still more to retard and prevent the retrogression. Consequently the best way of decreasing the effects of retrogression in red soils is to turn in organic plant manures, and especially dung, as often and as regularly as possible. . . .

"When . . . superphosphate is employed the author recommends that dung should always be used according to the following rules: (1) The dung should be well decomposed . . ., and (2) it should be well mixed with the superphosphate shortly before application, according to the phosphate content of the soil and the requirements of the crop, at from 1 to 2 cwt. of superphosphate per ton of well-decomposed dung."

Electro-potash as a fertilizer, S. Rhodin (*K. Landtbr. Akad. Handl. och Tidskr., 54 (1915), No. 8, pp. 710–729; Meddel, Centralanst. Försöksv. Jordbruksområdet, No. 119 (1915), pp. 22; abs. in Chem. Abs., 10 (1916), No. 7, p. 948*).—This is a progress report of field experiments with electrically-treated feldspar. The products of the Lindblad and Yngstrom method are so far the most promising. The fertilizing value of these substances was found to be very largely dependent upon the nature of the humus in the soil, type of plant, and vegetation period.

Influence of calcium and magnesium compounds on plant growth, F. A. Wyatt (*U. S. Dept. Agr. Jour. Agr. Research, 6 (1916), No. 16, pp. 589–620, pls. 6*).—Experiments conducted at the Illinois Experiment Station on the effects of calcium and magnesium on wheat, alfalfa, soy beans, cowpeas, oats, timothy, and sweet clover when applied in different natural and in artificially prepared forms, and to determine the amount of calcium and magnesium which the plants could tolerate, together with the relation between the ratios of these two elements in the plants, in the soils, and in the materials applied, are reported.

"Dolomite, limestone, magnesite, calcareous soils, and brown silt loam were used as souces of the natural forms, while prepared materials, such as the carbonates, chlorids, and sulphates served as sources of the artificial forms. . . . The earlier applications varied from 0.1 to 0.6 per cent of magnesium added in magnesium carbonate and in magnesite. Later the following amounts were employed: 2, 6, and 10 per cent of magnesium in magnesite; 10 and 12.7 per cent of magnesium in dolomite; 0.1, 0.01, and 0.001 per cent of magnesium in the carbonates, chlorids, and sulphates. In each series sand or soil was used as a control."

The following conclusions are drawn:

"Wheat, soy beans, alfalfa, and cowpeas grew normally either in 96 per cent of dolomite and 4 per cent sand, 100 per cent of magnesian limestone, or in sand containing 8 per cent of magnesite. Dolomite up to 40 per cent proved beneficial to plant growth. These results indicate that dolomite and magnesian limestone will not be detrimental as applied in agricultural practices. Applications of prepared magnesium carbonate up to 0.7 per cent caused no injury in brown silt loam, but 0.35 per cent prevented the growth of all plants tested in sand.

"The crop yields and the ratio of calcium to magnesium in the plants bear no direct relation to the ratio in the natural carbonates applied. Different ratios of calcium to magnesium within rather wide limits produced no marked differences in yields. Increasing the size of applications increased the calcium and magnesium content of plants.

"A tolerance of calcium and magnesium occurred in all varieties of plants grown. With approximately identical yields, wheat straw grown in sand, brown silt loam, dolomite, and soil containing 35 per cent of magnesite showed calcium contents varying between 0.165 and 0.547 per cent and magnesium contents varying between 0.132 and 0.955 per cent.

"Acid extractions failed to remove all the calcium and magnesium from the sand. There remained after the various extractions from 763 to 852 mg. of calcium and from 540 to 960 mg. of magnesium per 6,000 gm. of sand. The

plants possessed a decided ability to obtain calcium and magnesium from sand extracted with strong hydrochloric acid."

A list of 42 references to literature bearing on the subject is appended.

Sour soils and liming, W. Frear (*Penn. Dept. Agr. Bul. 261 (1915), pp. 221*).—This bulletin, a revision of Bulletin 61 (E. S. R., 12, p. 627), deals with soil acidity and the use of various limestone products for its correction, the object being to present in logical order the present knowledge on the subject, with special reference to the results of American studies, particularly those made at the Pennsylvania Experiment Station. An extensive set of practical conclusions is included, most of which have been noted from other sources, especially the Pennsylvania Station reports.

It is concluded that in soil formation the rocks lose much of their basic materials, lime especially, the final result of which is an acid residue, particularly where colloidal minerals and organic residues from decay accumulate. "This acid condition is immediately due to a great variety of materials, some the result of soil weathering, some of crop action, in slight degree of the early products of plant decay; often, and in much greater degree, of the later, more resistant residues from decay; and finally to various additions, fertilizers, or substances added for other purposes. When the acidity-producing substances are themselves readily decomposable plant materials, their early destruction usually follows, and their alkaline mineral constituents are released. As a result, their acid effect is only temporary. When, however, the cause is an unsatisfied colloid, mineral or organic, a material but slowly decomposable in the soil, the acid condition is permanent, though variable in degree, as conditions of cropping, cultivation, etc., tend to increase or decrease the acidity. . . .

"Soil cultivation hastens the decay of organic materials. . . . The tendency of stirring the soil, as by the use of cultivated fallow, should be to reduce acidity. . . . The acid-producing effect of commercial fertilizers is usually not very great. The nitrates tend to leave alkaline residues. The acid phosphates take very little lime to make them neutral or alkaline. Calcium sulphate is, in silty loam soil, of but slight effect, although on clay loams and clays it may be more active. The potash salts, in the amounts ordinarily applied, are not of large influence in this respect. Thomas slag is mildly alkaline in its effect. Ammonium sulphate is the most conspicuous producer of acidity. Its continuous use inevitably tends to produce pronounced acidity in the soil. . . .

"The kinds of plants occurring on a soil and the manner of their growth usually give the first evidence of [acidity]. Clover failure . . . and the replacing of the sweet grasses by plantain, moss, and sorrel, are the common signs. . . . Careful cultivation stimulates soil fermentations. These will, sooner or later, destroy temporary acidity. Mild acidity of a more permanent character may be overcome by the use of nitrate of soda and basic slag, both of which have alkaline residual effects. Where, however, the acidity is pronounced . . . lime, pulverized limestone and leached wood ashes, marls, and oyster shells, burned or raw and pulverized, are the only materials powerful enough and cheap enough for the purpose."

Lime and its uses in agriculture, R. Harcourt (*Ontario Dept. Agr. Bul. 238 (1916), pp. 12*).—This bulletin deals with soil acidity, the forms and uses of lime in agriculture, and the action of lime in soils.

Liming and inoculating soils, C. S. Dorchester, T. R. Douglass, and P. C. Taff (*Iowa State Col. Agr. Ext. Bul. 40 (1916), pp. [4], figs. 3*).—The general lime requirements of Iowa soils are discussed. Ground limestone is considered the best kind of lime to use on these soils. Methods of inoculation of soils for legume growing are also briefly described.

The relation of sulphur to soil productivity, F. L. Duley (*Jour. Amer. Soc. Agron., 8 (1916), No. 3, pp. 154–160*).—Sand and silt loam soil culture experiments conducted at the Missouri Experiment Station to determine the influence of flowers of sulphur and other sulphur compounds on corn, rape, and clover and on soil with no crop are reported. Analyses of samples of nine of the more important soil types of the State showed sulphur contents varying from 0.014 to 0.053 per cent.

It was found that "flowers of sulphur partly took the place of a soluble sulphate in a nutrient solution when used in a sand medium and had a marked effect upon the production of chlorophyll in corn plants. When used alone flowers of sulphur was slightly beneficial to the growth of corn and rape, and still more beneficial to the yield of red clover on the type of soil used in these experiments. Flowers of sulphur very markedly increased the production of nodules on the roots of red clover [and] was oxidized to sulphate in both sand and soil cultures. It slightly increased soil acidity and the lime requirement was directly correlated with the amount of soluble sulphate. The nitrate content varied inversely with the amount of soluble sulphate in the soil."

Can lithia be a constituent of plant food? P. D. Hahn (*So. African Jour. Sci., 12 (1916), No. 6, pp. 227–229*).—Experiments are reported which indicate "that lithium compounds in the presence of potassium compounds do not influence the growth of wheat in water cultures during the first period of vegetation, whereas in the later period the growth of the plants is rather retarded and the formation of grains prevented."

[Analyses of fertilizers and fertilizing material], R. E. Rose and F. T. Wilson (*Fla. Quart. Bul. Agr. Dept., 26 (1916), No. 2, pp. 98–115*).—This section contains the results of actual and guarantied analyses of 167 samples of fertilizers and fertilizing materials offered for sale in Florida in 1916.

Commercial fertilizers, W. J. Jones, Jr., F. D. Fuller, E. G. Proulx, R. B. Deemer, R. B. Bitler, and H. C. Mugg (*Indiana Sta. Bul. 186 (1916), pp. 1052*).—This bulletin contains the results of actual and guarantied analyses of 1,368 samples of fertilizers and fertilizing materials offered for sale in Indiana during 1915.

Official report [of Ohio] on commercial fertilizers and agricultural lime licensed, inspected, and analyzed during the year 1913 (*Ann. Rpt. Ohio Bd. Agr., 68 (1913), pp. 401–633*).—This report contains a number of brief popular special articles on fertilizers and their uses, and the results of actual and guarantied analyses of 814 samples of fertilizers and fertilizing materials and of agricultural lime collected for inspection in Ohio during 1913, together with a list of licensed brands of fertilizers.

AGRICULTURAL BOTANY.

Life cycles of the bacteria, F. Löhnis and N. R. Smith (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916) No. 18, pp. 675–702, pls. 7, fig. 1*).—According to the authors, under certain conditions all bacteria pass over into an amorphous or "symplastic" stage, appearing under the microscope either as an unstainable or a readily stainable mass without any easily distinguishable organization, which, if not discarded as dead, later gives rise to new regenerated forms frequently of characteristic and unusual appearance. In a study of 42 strains of bacteria, it was found that all lived alternately in an organized and in an amorphous stage. It is also stated that bacteria multiply not only by fission but by the formation of gonidia, some of which are filterable and produce new bacteria either directly or after having entered the symplastic stage. The

life cycle of each species of bacteria studied was found to embrace several subcycles showing wide morphological and physiological differences.

Studies of Bacillus radicicola, J. C. TEMPLE (*Georgia Sta. Bul. 120 (1916), pp. 67–80, figs. 6*).—Studies are reported of the use of cultures for inoculating legumes and of the employment of sterilized soil as a medium for growing *B. radicicola.*

A number of commercial cultures were tested on different media, including soil, and the number of viable bacteria in the sample was determined. The results given in detail in a table show a relatively high bacterial content of the cultures grown in soil. To secure data on the life of *B. radicicola* on dry seed Canada field peas were inoculated and stored in a loosely stoppered bottle after drying. Seeds from this lot were planted in bottles of sterilized sand at intervals of thirty days. Nodules were formed on all plantings up to the fifth month.

The purpose of the study of sterilized soil as a medium for growing *B. radicicola* was to determine whether this organism grows more vigorously in soil than in the usual culture solutions, and how the longevity of the two kinds of cultures compares.

Two sets of samples were started May 22, 1912, one inoculated with *B. radicicola* from soy bean and the other with the similar organism from crimson clover. Counts of the soy bean culture made on different dates showed that from the second week on the number of bacteria in the soil greatly exceeded the number in solution and in the soil the increase continued as long as the tenth week, while in the solution the maximum was reached in two weeks when the number of bacteria was only about one-tenth that in the soil sample. The crimson clover culture grew less vigorously but the soil appeared to be much more favorable for its development than the culture solution. The soil culture used March 17, 1916, to inoculate crimson clover in tubes was able to produce numerous nodules. Similar results were secured with alfalfa cultures. In each experiment the soil cultures showed the greater longevity.

An experiment was conducted also to determine what influence various substances used in the preparation of media have on the development of *B. radicicola* in solutions and in soil. The results indicated that of the different sugars used cane sugar and dextrose were very much superior to lactose, while levulose was of no value. A repetition of the experiment also indicated that levulose was entirely unsuited to this organism. The presence of ground alfalfa caused rapid multiplication in solution and in soil, the larger number being in the soil.

The evidence brought out by these experiments indicated that of the different media compared sterilized soil, with the addition of a small amount of leguminous material, was the best medium for the propagation of *B. radicicola.*

The influence of energy material upon the relation of soil micro-organisms to soluble plant food, C. J. T. DORYLAND (*North Dakota Sta. Bul. 116 (1916), pp. 319–401, figs. 2*).—Following a review and discussion of previous work, results are given of an extended study of six common ammonifying organisms to test their ability to consume ammonia in the presence of dextrose as a source of energy. The organisms used were *Bacterium mycoides, B. subtilis, B. megatherium, B. proteus, B. vulgatus,* and *Sarcina lutea.* In the experiments the author investigated the ability of these organisms to grow and produce ammonia from casein in both the presence and the absence of dextrose; the effect of increasing quantities of dextrose upon the number of bacteria and the ammonia production in the casein solution; the competitive action between the ammonifying bacteria and maize seedlings when grown in the presence of dextrose; the effect of adding ammonium sulphate, potassium nitrate, casein, or manure on the growth of oats in quartz sand to which dextrose had been added; the

ammonia and nitrate consuming power of certain soils; and the effect of dextrose and straw upon this consuming power.

All the organisms were found capable of assimilating ammonia from ammonium sulphate when dextrose was present as a source of energy. The presence of dextrose was not found to inhibit the multiplication of organisms in casein solution, but it did sometimes lessen the amount of casein decomposed. All the bacteria experimented with in synthetic solutions containing dextrose and all necessary plant food elements with ammonium sulphate as a source of nitrogen successfully competed with maize seedlings for plant food elements when grown in quartz sand containing 12 per cent moisture and maintained under conditions that exclude other organisms. Under the conditions of the experiment the difference observed in the growth of maize seedlings in the presence and the absence of dextrose is attributed almost wholly to the competitive action of the bacteria. The author claims that soils have a definite nitrogen and ammonia consuming power and that when large quantities of straw are added to the soil there is a marked decrease in the ammonifying power and a marked increase in the ammonia and nitrate consuming power. Within certain limits the number of bacteria and the ammonification of casein by *B. mycoides* is proportional to the quantity of phosphorus or potassium added, when these elements are present in limited amounts.

As a result of his investigations the author is led to believe that the so-called ammonia-consuming power can not be used as an index of soil fertility. Molds are considered to play an important part in the aerobic decomposition processes of the soil, and they have been found active in the assimilation of plant food constituents during the first stages of decomposition of crop residues and later may play as important a part as bacteria in liberating plant food constituents. Yeast and algæ are also considered possible important factors in this regard.

The scope and relations of taxonomic botany, A. S. Hitchcock (*Science, n. ser., 43 (1916), No. 1106, pp. 331–342*).—This is the address of the retiring president of the Botanical Society of America delivered at Columbus, Ohio, on December 29, 1915.

Drug plants of North Dakota, Mae A. Englehorn (*North Dakota Sta. Spec. Bul., 4 (1916), No. 6, pp. 132–148*).—Descriptive lists are given of some drug plants native to North Dakota, 21 of the species being recognized as official, 9 formerly so considered, and 39 unofficial drug plants which are thought to have some therapeutic value.

Notes on Quamasia with a description of a new species, C. V. Piper (*Proc. Biol. Soc. Wash., 29 (1916), pp. 77–81*).—Notes are given on a number of species of the genus Quamasia, and *Q. walpolei* n. sp. is described.

Branching and flowering habits of cacao and patashte, O. F. Cook (*U. S. Nat. Mus., Contrib. Nat. Herbarium, 17 (1916), pt. 8, pp. IX+609–625, pls. 11*).—Results are given of field studies of the characters and habits of the cacao tree (*Theobroma cacao*), together with the related food tree, *Tribroma bicolor.*

The double stock, its history and behavior, Edith R. Saunders (*Jour. Roy. Hort. Soc., 40 (1915), No. 3, pp. 450–472*).—This is a lecture delivered at the meeting of the British Association for the Advancement of Science in Australia in August, 1914.

In giving more particular attention to the fact that the proportion of doubles in a college garden at Cambridge was found to be far in excess of expectations, the author states that this appears from experiments to result ordinarily from a process of unconscious selection by the gardener in favor of the plants producing doubles by taking more forward and better grown plants to fill the beds and discarding the rest. The strain is always kept going, the seed har-

vested in one year supplying the plants for the next season but one. Single plants were found to be slower growing from the first and to present a less robust appearance at the time of planting out than their sister doubles of the same sowing. The results of the tests made entirely refute the statement that this particular strain is in any way exceptional as regards the output of doubles. It is thought that when the vegetative period is sufficiently prolonged to render the method of selection by vigor practicable, this method may be successfully employed by the gardener, securing in this way a much larger proportion of doubles than is ordinarily obtained.

A suggested explanation of the abnormally high records of doubles quoted by growers of stocks (Matthiola), Edith R. Saunders (*Jour. Genetics, 5 (1915), No. 2, pp. 137–143*).—The author states that she is now able to give in full the evidence upon which rests the main conclusion in her paper noted above. This evidence is said to be based upon a comparison of results obtained in the flower bed with those of a controlled experiment employing the same materials, showing that the apparent excess output of doubles in the first case is fictitious, and upon a comparison of the number of singles and doubles recorded among the more and the less vigorous individuals, respectively, showing that a proportion in excess of expectation furnished by the more vigorous individuals is counterbalanced by a corresponding deficit among the less vigorous plants. The conclusion is reached that doubles on the whole develop more rapidly and vigorously than singles, and that when the period of development is sufficiently prolonged, selection based upon this difference can be used as a means of securing a higher number of doubles in the beds than corresponds with the actual number from the parent plants.

On the relation of half-hoariness in Matthiola to glabrousness and full hoariness, Edith R. Saunders (*Jour. Genetics, 5 (1916), No. 3, pp. 145–158*).—An account is given of further studies of the relation between hoariness or glabrousness and sap color. These studies are said to establish fully the conclusions formulated in a previous report (E. S. R., 28, p. 228).

The results recorded in this and the earlier paper are considered to form a concordant body of facts concerning surface character which the suggested scheme of factor relations allows to be brought together in a comprehensible whole. These factor relations are supposed to involve five factors, which interact as three distinct pairs. The behavior of the different paired factors is described at length.

Pollen sterility in relation to crossing, R. R. Gates and T. H. Goodspeed (*Science, n. ser., 43 (1916), No. 1120, pp. 859–861*).—Preliminary observations made on a number of species of plants indicate that geographically isolated species do not invariably have good pollen and that pollen sterility is by no means a sure sign of hybridity. Pollen sterility is considered a physiological condition which occurs in all degrees of intensity and may be due to a variety of causes, hybridity being one of them.

On the germination of the pollen grains of apple and other fruit trees, J. Adams (*Bot. Gaz., 61 (1916), No. 2, pp. 131–147*).—Giving the results of preliminary observations made in 1913 regarding the germination of pollen grains in cane sugar solutions ranging in strength from 2.5 to 50 per cent, most of the experiments relating to apple, the author states that some varieties of the same species appeared to have more vigorous pollen grains than others. The pollen grains germinated either in light or in darkness. The quickest germination was observed at temperatures of 21 to 23° C. (69.8 to 73.4° F.). A few pollen grains of apple formed short tubes after being kept dry for three months, some of pear after ten weeks. Pollen grains of strawberry, loganberry, and raspberry were dead after two months, those of black currants after eleven weeks.

Vegetative succession under irrigation, J. F. MACBRIDE (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 19, pp. 741–760, pls. 8*).—In a contribution from the Wyoming Experiment Station, the author gives an account of observations on vegetative succession under irrigation on a ranch in Albany County, Wyo.

In order to increase the yield of hay from this ranch, irrigation was resorted to, and it was found that the artificial formation of natural meadows is brought about by a gradual change divisible into several stages each of which is characterized by one or more particular species of plants. The relative permanence of these stages may be controlled by regulation of the water supply. *Agropyron* spp. and *Deschampsia cæspitosa* are said to furnish the most valuable hay.

A single climatic index to represent both moisture and temperature conditions as related to plants, B. E. LIVINGSTON (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 362*).—A method is described by which the indexes of precipitation, atmospheric evaporating power, and temperature efficiency for plant growth for any period of time may be combined into a single index of moisture-temperature efficiency. Based on this index, a new climatic chart of the United States for the period of the average frostless season has been prepared.

A living climatological instrument, B. E. LIVINGSTON and F. T. MCLEAN (*Abs. in Science, n. ser., 43 (1916), No. 1106, pp. 362, 363*).—The authors describe a method for comparing the effectiveness of climates in promoting the growth of standard plants.

In these experiments soy beans were grown in pots always filled with the same kind of soil, the seed being soaked in water at a given temperature for a certain time before planting. Measurements were made on the plant after two and again after four weeks, when the cultures were discontinued. New cultures were started every two weeks and the climatic efficiency for plant growth was determined from the plant measurements made after two and four weeks. The value of the climate for any two to four week period at any station may be compared with that for any other period at the same or at any other station.

The daily march of transpiring power as indicated by the porometer and by standardized hygrometric paper, S. F. TRELEASE and B. F. LIVINGSTON (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 363*).—The authors have determined the transpiring power of the lower surfaces of Zebrina leaves by means of standardized cobalt chlorid paper, and at the same time porometer readings were made.

It was found that the porometer rates furnish data for deriving stomatal diffusive capacity, but that this capacity is not quite proportional to transpiring power. Transpiring power was found mainly dependent upon the degree of stomatal opening, but other conditions were influential.

The transpiring power of plants as influenced by differences of altitude and habitat, F. SHREVE (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 363*).—Measurements were made of the transpiring power of the leaves of some 20 species of plants in the desert and encinal regions of the Santa Catalina Mountains in southern Arizona in the arid foresummer of 1915. The species investigated belonged to different life forms, which were found to differ in their transpiring power and in the character of its daily changes. The same species exhibited a higher transpiring power in the individuals which grow in the flood plains than in those which grow on arid slopes. The daily changes in the former individuals are concordant with the daily march of evaporation, while in the case of the latter the transpiring power falls sharply before the daily maximum of evaporation is reached. A comparison of the transpiring power of the same species at different elevations has shown that the daily check is applied earlier

in the day at lower elevations and later at higher ones. The values for the transpiring power in all cases were found to be higher at the lower elevations, but at the higher elevations the values are sustained through a longer portion of the day.

The interrelation of transpiration, root absorption and water-absorbing capacity of tissues in an Opuntia, Edith B. Shreve (*Abs. in Science, n. ser., 43 (1916), No. 1106, pp. 361, 362*).—The author gives a summary of investigations conducted to test the conclusion of other workers that the transpiring power is greater in cacti during the night than during the day.

As a result of her investigation it was found that the transpiring power is greatly influenced by light intensity, air temperature, water content of tissues, and available soil water. The day to night variations in transpiring power of tissue are independent of any day to night variations in root absorption. During the daylight hours more water was absorbed by the root than was lost by transpiration, while at night the reverse was true. Variations in water intake by the roots are due, on the one hand, to variations in the soil retentivity, and, on the other, to variations in the plant itself. Stomata, as a rule, are shut during the day and open at night, but it was not possible to ascertain whether the closing of the stomata accompanies or follows a decrease in transpiration rate. The water-absorbing power of pieces cut from internal tissue was less during the night than during the day, being least from 4 to 5 a. m. and greatest from 3 to 5 p. m. This was true whether the calculations were based on dry weight or on the original weight of the material. The author advances the theory that the water-absorbing capacity of the internal tissue controls the secondary absorbing power of the roots, and probably also the transpiring power.

The influence exerted by light intensity and air temperature, together with their duration, show that the variations in absorbing capacity are due, at least in part, to chemical changes brought about by the metabolic processes, and many tests show that the changes in the water-absorbing capacity of the tissues parallel acidity changes in the plants in such a way that when acidity is highest the absorbing capacity is lowest, and vice versa. Certain exceptions occur, however, which show that the relation can not be so simple as the influence of mere changes in hydrogen ion concentration. Other factors, it is claimed, must be taken into consideration, including the accumulation and disappearance of the salts of organic acids. The author claims that it is impossible to state as yet whether the absorbing capacity of the internal tissue is due to colloidal absorption, osmotic forces, or both.

Measurement of the surface forces in soils, C. A. Shull (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 361*).—An examination of the absorption of water by dry Xanthium seeds is said to have shown that the internal forces had an initial value of at least 965 atmospheres. The internal forces have been determined at various moisture contents. Dry seeds were used to measure the surface holding power of soils for water, with the result that both the seeds and air dry soil were found to have approximately the same force.

As the capillary moisture increased, the surface moisture decreased until, at the wilting coefficient of the soil, the amount of back pull exerted was not more than 3 or 4 atmospheres. This relation was found to hold essentially for all types of soils from heavy clay to sand. The soil, at the critical moisture content of the plant, it is claimed, holds the water with less force than the osmotic pressure of the root hairs of the plant, as determined by plasmolytic methods. The wilting of the plant, it is believed, does not result from lack of moisture or lack of a gradient toward the plant, but probably from the low rate of movement of water due to the friction in thin films.

Fiber measurement studies: A comparison of tracheid dimensions in longleaf pine and Douglas fir, with data on the strength and length, mean diameter and thickness of wall of the tracheids, ELOISE GERRY (*Abs. in Science, n. ser., 43 (1916), No. 1106, p. 360*).—This is a progress report on fiber dimension studies as a part of the investigation into the mechanical, physical, and chemical properties of the longleaf pine (*Pinus palustris*) and Douglas fir (*Pseudotsuga taxifolia*), the work being conducted at the Forest Products Laboratory, United States Department of Agriculture, Madison, Wis. Data were collected from microscopic investigations made at every tenth annual ring on large cross sections from old trees.

The results obtained show no evidence of a constant fiber length such as was reported by Sanio for the Scots pine. Many more bordered pits were found in the spring than in the summer wood tracheids. The ends of the tracheids were frequently blunt or forked, though they are generally pointed in the summer wood. As a rule, the summer wood tracheids are shorter than the spring wood tracheids in all the material studied.

A rapid increase in all dimensions was found during the first 20 years of growth. The variation in length in a single tree was found to be from 0.8 to 7.65 mm. A direct relation was found to exist in the Douglas fir studied between the thickness of the cell walls of the summer wood and the strength of the material. In young wood, strength of material and thickness of wall were both low. No marked relation was found to exist between width of ring and fiber dimensions, nor was there any decline in the size of the elements due to age of the tree.

The Douglas fir and pine were not found to differ widely in the dimensions of their elements. Thickness of wall averaged higher in the longleaf pine, but the diameters were somewhat less than in the Douglas fir.

Permeability and viscosity, W. J. V. OSTERHOUT (*Science, n. ser., 43 (1916), No. 1120, pp. 857–859*).—Criticisms are given of the theory of Spaeth that the permeability of the surface layer of protoplasm is determined by its viscosity, which, in turn, depends on its colloidal condition.

Hail injury to cultivated plants, J. WEIGERT (*Landw. Jahrb. Bayern, 3 (1913), No. 2, pp. 49–57*).—This deals briefly with hail injury to maize, small grains, potatoes, beets, tobacco, vines, and fruit trees, with a few references to related contributions on this subject.

The injurious effect of tarvia fumes on vegetation, A. H. CHIVERS (*Abs. in Science, n. ser., 43 (1916), No. 1106, pp. 363, 364*).—An account is given of the destruction of a garden in Hanover, N. H., by fumes of a tar compound used on roads. The injury was found to be due to the constituents of the volatile substances, which condensed in the form of an oily coating on the surfaces of the plants, and did not involve to any extent the passage of gases through the stomata. The amout of injury was found to vary with the distance from the escaping fumes, the temperature of the melting tar, and the age of the plant structures.

FIELD CROPS.

Irrigated pastures for northern reclamation projects, F. D. FARRELL (*U. S. Dept. Agr., Bur. Plant Indus., Irrigated Pastures for Northern Reclamation Projects, 1916, pp. 16, figs. 2*).—Based on experiments with irrigated pastures at several field stations and on observations made and information gathered on northern reclamation projects and in some of the other irrigated districts of the same region, directions are presented for the establishment and management of pastures under irrigation.

At the Huntley field station in Montana in 1914 and 1915, 2 cows were pastured each year for a season of approximately five months on three quarter-acre plats of mixed grasses and clovers. This represented a stock-carrying capacity of about 2.6 cows per acre. At the Gooding Experiment Station, Idaho, experiments conducted for three years showed the stock-carrying capacity per acre to be from 2 to 3 cows, 10 to 14 mature lambs, 10 to 12 ewes with their lambs, and 3 2-year-old steers per acre. At Huntley in 1915 a yearling heifer was placed on a quarter-acre plat of spring-seeded pasture on August 27 when the grasses average about 10 in. in height. The plat was divided into two parts which were grazed alternately and the heifer remained on the pasture for 58 days, the carrying capacity being rated at 4 yearlings per acre. At this farm the grazing periods on pasture plats averaged from 12 to 15 days.

In discussing the irrigation of pastures it is pointed out that at Gooding pastures were irrigated from nine to eleven times each year for three years, receiving from 2.48 to 2.73 acre-feet of water per acre each year. The quantity of water was no greater than was necessary for alfalfa though about 50 per cent more than needed for spring grains and potatoes. Decidedly beneficial effects were noted at the Huntley station from the application of a top-dressing of manure to 2-year-old pastures.

[Influence of the depth of plowing on yield], I. Kolesnikov (*Zhur. Opytn. Agron., 15 (1914), No. 1, pp. 33, 34*).—The Don Experiment Station, conducting experiments with different depths of plowing, observed that the greater yield was obtained in all cases by plowing about 9.5 in. deep, while plowing to a depth of only 3.5 in. brought a marked reduction. As compared with plowing 3.5 in. deep, the average yields for the past ten years showed an increase of 10.5 per cent for the depth of 9.5 in. and of 6.9 per cent for the depth of 7 in.

Grains for the Montana dry lands, N. C. Donaldson (*U. S. Dept. Agr., Farmers' Bul. 749 (1916), pp. 22, figs. 11*).—This bulletin presents information regarding the varieties of winter wheat, spring wheat, oats, barley, and flax adapted to the dry lands of Montana, and the best methods of growing them as indicated in part by the results of tests conducted for the past eight years at the Judith Basin Substation, Moccasin, Mont., in cooperation with the Montana Experiment Station.

The varieties regarded as best are Kharkof winter wheat, Pelissier durum wheat, Marquis spring wheat, Sixty-Day oats, White Smyrna barley, and Russian flax. It is recommended that winter wheat be sown at any time between August 10 and September 10 at the rate of 3 pk. per acre, and that spring wheat, oats, and barley be sown as early as the land can be prepared. The best time for sowing flax is given as April 15 to May 1. The rates of seeding for spring grain crops recommended are as follows: Wheat 4 pk. to the acre, oats 4 to 5 pk., hulled barley 5 pk., hull-less barley 4 pk., and flax 15 to 20 lbs. Summer fallowing is not recommended as a general practice, and the use of a cultivated crop such as corn is suggested as a substitute for fallow as grain seeded on disked corn ground yields nearly as well as grain on fallow. It is suggested that fall-plowed land be left rough to catch the snow and prevent the soil from blowing and that spring-plowed land for spring grain be worked down immediately after plowing.

Corn in Montana, A. Atkinson and M. L. Wilson (*Montana Sta. Circ. 53 (1916), pp. 109–163, figs. 26*).—This circular is made up of extracts from Bulletin 107 of the station, already noted (E. S. R., 35, p. 338).

Selecting and curing seed corn, A. Atkinson and M. L. Wilson (*Montana Sta. Circ. 54 (1916), pp. 165–184, figs. 23*).—This circular describes and discusses practical methods of field selection, drying, testing for germination, and preparing for planting of seed corn under Montana conditions and requirements.

The culture of jute in India and Indo-China, L. Hautefeuille (*Bul. Econ. Indochine, n. ser., 18 (1915), Nos. 113, pp. 265–332; 114, pp. 490–534*).—The jute industry in these regions, including production, commerce, and manufacture, is discussed from many different standpoints, and the results of cultural and fertilizer experiments conducted by the author and others during the past 10 to 15 years are briefly reviewed. The results of numerous fiber determinations of varieties of the two principal species, *Corchorus capsularis* and *C. olitorius*, are given in tables. Economic and sociological conditions as related to the jute industry are also considered.

[Serradella, with reference to economic value, inoculation, and development on light and heavy soils], B. Heinze (*Naturwissenschaften, 3 (1915), Nos. 26, pp. 339–343; 27, pp. 352–355*).—This article discusses the plant from historical, botanical, and cultural points of view and reports briefly the results of culture tests on heavy soil at Lauchstedt, together with those of analytical studies setting forth especially dry matter content and nitrogen production. The points considered are the appearance of the plant, its development, soil and climatic requirements, its uses in field, orchard, and garden, the importance of proper inoculation, soil preparation and fertilization, and diseases and insect enemies.

In the experiment reported the best results were secured where serradella was grown two years in succession. The plants there developed numerous nodules on their roots, were of dark green color, and produced two cuttings of one meter in height in addition to pasture, the two cuttings corresponding to 67,473 lbs. of green substance or 10,442 lbs. of air-dry material per acre. The roots are reported as containing 2.76 per cent and the stems and leaves 3.3 per cent of nitrogen. Where grown after mustard and on soil never having produced the crop, no nodules developed, the plants were of a light yellowish green color, and the nitrogen production per acre amounted to only 46.4 lbs. After lupines serradella grown on the land for the first time developed approximately as well as on the same kind of soil on which the crop had been grown before.

Pot experiments with manganese as a fertilizer for sugar beets, O. Fallada and I. K. Greisenegger (*Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 44 (1915), No. 5, pp. 379–388*).—Manganese sulphate was applied at the rates of 25, 50, and 100 kg. per hectare (22.3 to 89 lbs. per acre), and manganese dioxid at the rates of 150, 300, and 600 kg. per hectare.

The use of 50 kg. of manganese sulphate and of 150 kg. of manganese dixoid per hectare gave the best general results. The check tests produced an average of 348.3 gm. of beets with 21.45 per cent of sugar in the juice, and a purity coefficient of 89.8 per cent. The tests in which 50 kg. of manganese sulphate was used gave 362.3 gm. of beets with 21.52 per cent of sugar and a purity of 92.2 per cent and the tests with 150 kg. of manganese dioxid yielded 367.3 gm. of beets containing 22.25 per cent of sugar with a purity of 93.3 per cent.

The sugar content of the beets did not appear to be influenced to a great extent through the application of these forms of manganese. The larger quantities applied apparently interfered with the growth of the plant, and reduced the yield of beets and sugar below the production of the check tests. The heavy applications reduced the growth of the leaves to a less extent than the development of the root, and also raised the water requirement of the plants as based on the production of organic matter or of sugar.

Methods of fertilizing sweet potatoes, C. E. Durst (*Illinois Sta. Bull. 188 (1916), pp. 268–278, fig. 1*).—This bulletin presents a report on fertilizer experiments with sweet potatoes conducted for five years in Union County on

eight plats, each one-thirty-third of an acre in size. A comparison was made of the use of 660 lbs. per acre of a home-mixed fertilizer consisting of 2 parts steamed bone, 2 parts dried blood, and 1 part potassium sulphate by weight; of 10.56 tons of manure; and of 528 lbs. of steamed bone; on two series of plats, on one of which the applications were made broadcast and on the other under the ridge upon which the sweet potato plants were placed.

The results indicated that each of the fertilizer treatments used increased the percentage of table potatoes produced and that, with the possible exception of the home-mixed fertilizer, higher percentages were secured when the fertilizer was applied under the ridge than when broadcasted. Each treatment also increased the total yield, the higher yields being secured from the fertilizer application made under the ridge. It was further indicated that only manure or steamed bone applied under the ridge is likely to give a material increase in the net value of the crop after deducting the cost of the fertilizer.

Studies of the timothy plant.—I, The influence of maturity upon the yield, composition, digestibility, palatability, and feeding value of timothy hay, H. J. WATERS ET AL. (*Missouri Sta. Research Bul. 19 (1915), pp. 2–68, figs. 37*).—The results of these studies, in progress for some years, are reported. The data secured are given in tables and are also presented graphically.

In studying the effect of maturity on yield, the first cutting was made about June 12 when the plants were just in full head, the second about June 20 when the plants were in full bloom, the third about July 1 when the seeds were beginning to form, the fourth about July 8 when the seed was in the dough, and the fifth about July 16 when the seed was ripe but not shattered. The average of all trials in which cuttings were made showed the largest yield from the third cutting and, regarding the value of this cutting as 100, the relative value of the fourth cutting was 99.3, the second 93.8, the fifth 89.7, and the first 89.4. The first and last cuttings produced an average of between 500 and 600 lbs. less hay per acre than was secured from the third and fourth cuttings.

The digestibility of the hay was found to decline steadily as the plant developed, beginning as early as when the plants are in full head. The second cutting, when the plants were in full bloom, gave the largest yield of digestible dry matter, protein, fat, crude fiber, and nitrogen-free extract. Tests on the palatability of the hay showed that yearling steers subsisting entirely on hay and milk cows receiving grain and other roughage besides the hay preferred the first, second, and third cuttings, while sheep full fed on mixed grain apparently ate one cutting with as much relish as another.

It was further observed that early cutting tended to weaken the stand and late cutting to conserve the strength of the plant and to prolong its life. Studies relating to the permanence of stand indicated that "the thick, vigorous stand following late cutting does not result from the new plants that have sprung from seed left on the land at the time of harvest, but from the new plants which have come from the perfectly developed and well-filled bulbs at the base of the old timothy plants. It is from these bulbs that new plants for the next year's stand come. The bulbs reach their full development only when the plants are allowed to become mature before being harvested."

While the earlier cuttings gave larger yields and hay of higher digestibility and palatability, the later cuttings afforded greater convenience in harvesting, the weather conditions being generally more favorable and less time being required for curing. The late-cut as compared with the early-cut hay was much less liable to injury from rains and dews, from sunburn and under or over curing, and also turned water in the shock or stack much better.

The results of an investigation of the reproduction of the timothy plant are summarized as follows: "A seed sown in the fall or early spring produces a single plant. In the spring this plant produces a stalk and head. The head flowers and produces seed. A bulb at the base of the stalk enlarges as the stalk increases in height and, about the time the head appears, new shoots spring from the bulb and develop into small plants which are attached and clustered about the central plant. A root system will develop later on each of these new plants, all at the expense of the parent bulb. The parent bulb reaches its full development at about the time the main seed-bearing head is ripe or a little while before. The secondary plants may continue to grow and may produce heads and bear seed before the close of the growing season if the season is favorable and if left undisturbed. Bulbs and roots develop on these new plants largely at the expense of the parent bulbs, which by this time becomes shriveled and soon dies, having fulfilled its function. At the close of the growing season these secondary bulbs are well developed and have established their own root systems. They remain dormant through the winter; in the spring they send forth the stalks which later head, flower, and produce seed in the usual manner, so the process of regeneration of the previous year is repeated."

The advantages of clover over timothy in the rotation are pointed out.

Studies of the timothy plant.—II, The changes in the chemical composition of the timothy plant during growth and ripening, with a comparative study of the wheat plant, P. F. TROWBRIDGE, L. D. HAIGH, and C. R. MOULTON (*Missouri Sta. Research Bul. 20 (1915), pp. 3–67, figs. 17*).—Studies were made of the changes in the chemical composition of the entire timothy plant during growth and ripening as compared with similar changes in the wheat plant. The results are discussed at some length, a review of the literature being included, and the data are given in detail in tables and graphs. For the purpose of the investigation samples of the timothy plant were secured as follows: May 23, 1908, when the plants were about 1 ft. high in rapid growth with no heads showing, June 6 when no stalks were in bloom but were beginning to head, June 18 when in full bloom, June 30 when just out of bloom and the seed formed, July 9 when the seed was in the dough, July 20 when the seed was fully ripe, and March 16, 1909, when growth had not yet started but the plants were considerably green. The wheat plant samples were collected as follows: May 23, 1908, when the plants were green and in bloom, June 4 when the seed had formed and was in the milk, June 11 when the seed was in the dough, and June 19 when the seed was fully ripe.

It was found that the timothy plant took up nitrogen and ash constituents at the most rapid rate and contained the highest percentage and amount of moisture in the green plant during its earlier stages of growth. The absorption of plant food continued, but at a decreasing rate corresponding to the decreasing rate of growth, as it approached maturity. The heads increased in dry matter throughout the growing and ripening period. This increase included all the plant constituents except potassium oxid which had reached its maximum before the plants were in full bloom. Nitrogen-free extract increased at the greatest rate of all constituents and as the heads approached full ripening a noticeable increase in phosphorus pentoxid was observed.

The stalks and leaves increased in dry matter during growth and ripening, the dry matter added consisting chiefly of crude fiber and nitrogen-free extract. Nitrogen, ether-soluble material, potassium oxid, and phosphorus pentoxid increased during growth but decreased to some extent during ripening. The bulbs increased in dry matter throughout the growing period but the amount became constant before the ripening of the hay. The matter stored was principally

nitrogenous matter and nitrogen-free extract, no starch being produced in the bulbs during the storing process. Potassium oxid was found in maximum amount in the first stage, while phosphorus pentoxid showed a tendency to increase in amount as the plant matured. Approximately as many heads were produced at the full height as there were bulbs at the beginning of the season's growth. It was further observed that the plant above ground loses an absolute amount of dry matter from the time the seed is in the dough until it is fully ripe as the result of washing by rain and dew and a falling off of dead parts.

The wheat plant was found to resemble the timothy plant in taking up its nitrogenous and mineral matter and in containing the highest percentage of moisture in the green plant in the earlier stages of growth, and also in losing an absolute amount of dry matter at the time of full ripening due to washing by rain and dew and the falling of dead parts. The heads gained more uniformly and rapidly in their amount of dry matter than any other part. Nitrogen-free extract was found to be produced and stored at a greater rate than any other constituent but nitrogen, ash, and ether-soluble matter were added in some quantity also. The fiber was determined as practically all formed by the time the blossom has fallen and as remaining constant to ripening. The stalks and leaves contained their maximum amount of dry matter at blossoming time, after which nitrogenous material and nitrogen-free extract passed to the ripening heads.

The roots and stubble increased in dry matter up to the milk stage, after which a decrease took place as the dry matter passed to the portion of the plant above ground. The fiber present in the roots did not decrease in amount but nitrogenous and ether-soluble matter, ash, and nitrogen-free extract passed out of the roots into the growing plant above ground during the ripening of the heads.

In both wheat and timothy plants the percentage of protein, ash, and ether extract showed a tendency to reach a higher value in the young than in the mature plant, while the percentage of crude fiber and nitrogen-free extract was the greater at maturity.

Hilling of Voandzeia subterranea, P. C. van der Wolk (*Cultura, 27 (1915), No. 328, pp. 405–417*).—This article discusses the peanut and *Voandzeia subterranea* and brings out their common and individual characteristics. Considerable attention is given to subterranean fruit production which is common in both plants.

In an experiment conducted to test the effect of hilling, as is practiced in peanut culture, the Voandzeia plants all died as the result of this method of cultivation. The author points out that hilling among other disadvantages brings about conditions which favor disease attacks.

Comparative variety tests with squarehead winter wheat from 1908 to 1910, C. Leverenz (*Arb. Deut. Landw. Gesell., No. 278 (1915), pp. XXVI+240+8, pls. 5*).—This report presents at considerable length and in great detail the results of cooperative tests of nine varieties of squarehead winter wheat conducted throughout Germany during the three years 1908 to 1910. The principal varieties were Original Strube Schlanstedt, Original Strube Silesian, and Original Leutewitz.

A summary based on the results of all the tests showed that the Strube Schlanstedt variety yielded an average of 3,051 kg. of grain and 4,984 kg. of straw per hectare (2,715 lbs. and 4,436 lbs. per acre, respectively), Silesian 2,646 kg. of grain and 5,271 kg. of straw, and Leutewitz 3,001 kg. of grain and 5,018 kg. of straw. Of about 158 tests relating to grain yield and 132 to straw production, 97 of each raised no question regarding methods used or the results

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obtained, and these taken by themselves showed higher yields in every case, but did not change the relative standing of the varieties. In the grain tests Strube Schlanstedt is stated to have ranked first 69 times and second 68 times, Silesian first 31 times and second 20 times, and Leutewitz first 60 times and second 71 times. For the three years Strube Schlanstedt gave an average 1,000-kernel weight of 38.24 gm., a liter weight of 764.3 gm., and a flintiness of 40.49 per cent; Strube Silesian a 1,000-kernel weight of 38.71 gm., a liter weight of 753.9 gm., and a flintiness of 30.14 per cent; and Leutewitz a 1,000-kernel weight of 38.16 gm., a liter weight of 763.9 gm., and a flintiness of 41.5 per cent.

Wheat culture in Argentina, C. D. Girola (*Bol. Min. Agr. [Buenos Aires], 19 (1915), No. 8–9, pp. 621–652, figs. 10*).—This article is a continuation of material published in 1904 (E. S. R., 16, p. 663). The following varieties of wheat, regarded as new for Argentina, are described from historical, botanical, and cultural standpoints: Karachi, Delhi, Huasan Clubwheat, White Andalgalá, Spanish, Chileno, Violet, Smooth Russian, and Pampas. Of these varieties White Andalgalá is a club wheat, and Spanish, Chileno, and Violet are durum wheats, while the rest belong to the common bread wheats.

The value of good seed, C. R. Zavitz (*Ann. Rpt. Live Stock Branch Ontario, 1914–15, pp. 73–76*).—A popular article on the subject, in which are discussed the varieties of field crops and the quantities of seed giving the best results as determined in experiments and by observations made by the Ontario Agricultural College, the Ontario Agricultural and Experimental Union, and other agricultural organizations.

Seed tests made at the station during 1915, M. T. Munn (*New York State Sta. Bul. 416 (1916), pp. 55–74; abridged ed., pp. 2*).—The results of purity tests of samples of seeds collected are reported in tables and are briefly discussed.

Of 323 official samples of seed from dealers' stocks 4.6 per cent were found to be violations of the seed law. Samples from correspondents for testing the purity numbered 777, a decrease as compared with the previous year.

Samples of orchard grass showed in some cases intentional adulteration with chaff and inert matter, and samples of Dwarf Essex rape seed adulteration with cheap bird rape seed and other varieties of rape and various kinds of mustard seed. Dodder was found in one sample of orchard grass seed into which it had been intentionally introduced, and over 10 per cent of the alfalfa seed samples contained dodder, in one instance to the extent of 2.5 per cent.

Agricultural value of impermeable seeds, G. T. Harrington (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 20, pp. 761–796, pl. 1, figs. 6*).—The results here reported are based on germination tests of lots of clover and alfalfa seed and a smaller number of such tests of winter vetch, okra, and other seeds, made to determine the agricultural value of seeds whose coats are impermeable to water at temperatures favorable for germination. It is pointed out that the cultivated species sometimes producing impermeable seeds include okra, alfilaria, atriplex, asparagus, morning-glory, canna, cherry-tomato, and nearly all of the cultivated species of Leguminosæ.

Commercial samples of 12 species of small-seeded legumes tested during the six years, 1904 to 1909, gave a range from 0.96 per cent of impermeable seeds in spring vetch to 71.67 per cent in spotted bur clover. The samples of white sweet clover, toothed bur clover, and yellow-flowered sickle lucern also contained high percentages of impermeable seeds. In a test of 128 lots of seed one to five years old and including red clover, alsike clover, white clover, sweet clover, alfalfa, hairy vetch, crimson clover, okra, *Chamæcrista nicitans*, and *Robinia pseudacacia*, over 90 per cent, and in most cases 100 per cent of the

impermeable seeds were viable except in the seed of *C. nicitans*. The average percentage of viability of the impermeable seeds was invariably greater than of the seeds which softened within six days.

In an experiment to determine the average rates of softening of seeds which had remained impermeable after ten days in wet blotters, less than 10 per cent of the seeds of red clover, alsike clover, white clover, and sweet clover softened in one month, and from about one-third to a little over one-half of them softened in three years when kept in wet blotters. Nearly all of the impermeable seeds of alfalfa, hairy vetch, okra, and crimson clover softened in one year, but a very few of all except crimson clover remained impermeable after three years.

In dry storage nearly all impermeable seeds of alsike clover, white clover, and sweet clover remained impermeable from two to three years. Impermeable red-clover seeds became permeable gradually in dry storage, but it was found that from one-third to two-thirds may still be impermeable after four years. Impermeable clover seeds thoroughly matured before harvesting as compared with similar seeds not so well matured softened and germinated more slowly under conditions favorable to germination and also became permeable more slowly in dry storage.

Among other methods of treatment reported it was found that alternations of temperature caused the softening and germination of many impermeable clover seeds when a temperature of 10° C. (50° F.) or cooler was used in alternation with a temperature of 20° or warmer. The effect of these alternations was greatly increased by previously exposing the seeds to germination conditions at 10° or cooler and was decreased by previously exposing the seeds to germination conditions at 30°.

Even under the most favorable conditions only a small proportion of impermeable seeds of red clover, alsike clover, white clover, and white sweet clover was found to produce seedlings promptly when sown in warm weather, and it was also observed that such seeds will pass the winter in the soil in a freezing climate without injury. The impermeable seeds of these species when placed in wet blotters softened and germinated more slowly than similar seeds of alfalfa, crimson clover, hairy vetch, and okra. All germinated within one year in some cases, while in others over 50 per cent were still impermeable after four years. It is stated that a large proportion of impermeable alfalfa, crimson clover, okra, and hairy vetch seeds will germinate in the soil during the first few months after planting, but that nearly all alfalfa and okra seeds, even if impermeable in the fall, are killed when they pass the winter in soil or on the plants out of doors in a freezing climate. Suggestions for the use of impermeable seeds are included.

HORTICULTURE.

The garden book, V. D. Davis (*New York: Orange Judd Co., 1915, pp. VIII+244, pls. 7, figs. 47*).—A popular treatise on the growing of vegetables under both home and market conditions.

The small garden, J. Schneider (*Der Kleingarten. Leipsic and Berlin: B. G. Teubner, 1915, pp. 95, figs. 80*).—A practical treatise on the propagation, culture, and care of fruits, vegetables, and flowers in the home garden, with special reference to German conditions.

The fruit growers' yearbook and market gardeners' guide, 1916 (*London: The Cable Printing & Publishing Co., Ltd., 1916, pp. 172, figs. 9*).—This yearbook contains a monthly working calendar for indoor and outdoor fruit growing in England, a review of the previous year's fruit and vegetable prices at Covent

Garden Market, and numerous miscellaneous articles dealing with the culture, care, and management of fruit under British conditions.

[Report of horticultural investigations], R. S. SETON (*Univ. Leeds and Yorkshire Council, Agr. Ed. [Pamphlet] 96 (1915), pp. 50–56, fig. 1*).—Fertilizer tests with strawberries as well as variety tests with potatoes, bush fruits, raspberries, and strawberries being conducted under the direction of the University of Leeds are reported. An experiment being conducted with various lawn mixtures is also outlined.

Methods used in the propagation of plants, T. D. HATFIELD (*Trans. Mass. Hort. Soc., 1916, pt. 1, pp. 89–102*).—In this paper the author discusses the different methods of propagation and their application in the propagation of various classes of plants.

Greenhouse heating (*New York: A. T. De La Mare Printing & Publishing Co., Ltd., 1916, pp. 52, figs. 2*).—This comprises a reprint of four prize essays which recently appeared in the columns of *The Florists' Exchange*. A digest of the essays, together with comments by J. McArthur and a collection of answers to questions on greenhouse heating, is also included.

Culture and forcing of Witloof chicory, J. W. WELLINGTON (*New York State Sta. Bul. 418 (1916), pp. 89–98, pls. 3*).—As a result of some forcing experiments conducted at the station it is believed that Witloof chicory deserves much greater attention at the hands of home gardeners and that at present prices it can not fail to give good financial returns to market gardeners.

This bulletin discusses the importance of Witloof chicory in Europe, its culture and varieties, and describes in detail the cultural methods employed at the station. The plants were easily grown from seed, and sand proved to be a very satisfactory medium with which to cover the forcing roots. It blanches the leaves perfectly and promotes the formation of compact heads. Roots having a crown diameter within the limits of 1 to 2 in. produced the greater number of marketable heads. Temperatures ranging from 50 to 60° F. appear to give optimum conditions for producing a marketable crop.

Witloof chicory, F. H. HALL (*New York State Sta. Bul. 418, popular ed. (1916), pp. 4, pls. 2*).—A popular edition of the above.

Transmission of resistance and susceptibility to blossom-end rot in tomatoes, H. P. STUCKEY (*Georgia Sta. Bul. 121 (1916), pp. 83–91 figs. 3*).—In previous work at the station it was found that the cherry, pear, and currant tomatoes were immune to the blossom-end rot (E. S. R., 26, p. 648). This bulletin gives the results of crosses between the cherry type and a commercial variety, with special reference to the transmission of resistance and susceptibility to the blossom-end rot.

The work indicates that both resistance and susceptibility are transmitted from parent to progeny. The fruit of the F_1 progeny of the cross between Red Cherry (*Lycopersicum cerasiforme*) and the variety Greater Baltimore (*L. esculentum*) was resistant to the blossom-end rot and was intermediate in size and number of locules between the two parents, but tending toward that of the cherry type. The F_2 progeny was likewise resistant to the blossom-end rot and varied widely in size of fruit and number of locules. At the same time no distinct Mendelian segregation of these two characters was observed.

Data are given showing the yield of a number of standard varieties and their susceptibility to the blossom-end rot. The immune varieties were either very early maturing or possessed cherry tomato blood. The Hybrid variety, the plants of which are the first generation progeny of the cross between the Red Cherry and Greater Baltimore, gave the highest yield of all the varieties,

this agreeing with the results obtained at the New York State Station relative to high yields from first generation hybrid tomato plants (E. S. R., 27, p. 239).

The control of fruit pests and diseases, A. L. MELANDER and F. D. HEALD (*Washington Sta. Popular Bul. 100 (1916), pp. 5–61*).—This describes the more important insect and animal pests and diseases of fruits and gives directions for their control, including information relative to the preparation of insecticides and fungicides.

Piping system for orchard spraying, G. P. WELDON (*Mo. Bul Com. Hort. Cal., 5 (1916), No. 8, pp. 273–277, figs. 3*).—A descriptive account with illustrations is given of an underground orchard piping system which was laid out in a California orchard for use in spraying the orchard.

The development of fruits for special conditions, W. T. MACOUN (*Trans. Mass. Hort. Soc., 1916, pt. 1, pp. 39–57*).—A review of American activities in the development of hardy fruits, including suggestions for further breeding along this line.

Pollinating fruit trees, L. G. CORRIE (*Jour. Heredity, 7 (1916), No. 8, pp. 365–369, fig. 1*).—In this paper the author discusses various problems connected with the failure of trees to set a crop, and summarizes the results of some long-continued pollination trials conducted at the John Innes Horticultural Institution at Merton, Surrey, England.

The newer fruits in 1915 and how secured, N. E. HANSEN (*Minn. Hort., 44 (1916), No. 8, pp. 307–312, figs. 2*).—In this paper the author notes the propagation in 1915 of two new plums that have borne several excellent crops, and summarizes his recent endeavors in the line of breeding pears resistant to both cold and blight.

Two hardy species of pears, *Pyrus ovoidea* and the birch-leaved pear (*P. betulifolia*), have been hybridized with many of the best cultivated pears of Europe and have been distributed for testing purposes.

The cherries of Japan, E. H. WILSON (*Pubs. Arnold Arboretum, No. 7, Sup. (1916), pp. III*).—In view of the appearance of Miyoshi's work on the cherries of Japan (E. S. R., 25, p. 645), which antedated the author's work (E. S. R., 35, p. 343) but was not received in time for consultation, the author here presents a supplement to his work containing a number of changes in nomenclature made to conform to the nomenclature of Miyoshi.

Harvesting and packing peaches, W. B. LANHAM (*Agr. and Mech. Col. Tex. Ext. Bul. B–22 (1916), pp. 8, figs. 8*).—Practical directions are given for picking, grading, and packing peaches, with special reference to the use of the Georgia carrier.

Pyronia, L. TRABUT (*Jour. Heredity, 7 (1916), No. 9, pp. 416–418, figs. 2*).—The pyronia (*Cydonia veitchii*), a hybrid which is said to be the first between the pear and quince, is here described and illustrated. The tree, which is growing at the botanic garden in Algeria, produces an abundance of seedless fruit of some value. The possibilities to plant breeders of using these two species for breeding other desirable fruits are pointed out.

The marketing of New York State peaches (*New York: New York Central Lines, 1916, pp. 16, figs. 9*).—The purpose of this pamphlet is to present definite information to peach growers and shippers of western New York relative to methods of marketing and distribution. The subject matter is based upon the shipping records of the New York Central and Hudson River Railroad Co. and information compiled from the 1915 Market News Letters of the Office of Markets and Rural Organization of the U. S. Department of Agriculture. Methods of improvement in the marketing of the 1916 peach crop are herein outlined.

Some notes on the breeding of raspberries, R. D. Anthony (*New York State Sta. Bul. 417 (1916), pp. 75–88, pls. 8*).—The author briefly reviews the earlier work in the breeding of raspberries at the station and discusses in more detail the results of crosses begun with the red, black, and purple raspberries in 1910.

The investigations have shown beyond doubt that the purple raspberries do not belong to a distinct species but have originated as hybrids of the blackcap and the red raspberry. Some very promising seedlings of these have been secured. The work shows that improved purple varieties are more apt to be developed by crossing reds and blacks than by selecting from the existing purple varieties. Pure seedlings of the purple raspberry Columbian, an F_1 hybrid, failed to break up as much as would be expected in the F_2 generation. None showed any tendency to propagate by suckers, nor did any have fruit of the color of either parent. In cane color and glaucousness some of the seedlings approached more nearly the parent types. Hybrid seedlings were produced by crossing two blackcaps with a red raspberry. With one cross the seedlings were all purple. Among the 289 seedlings of the other cross were ten yellows.

Performance records are given for several varieties of raspberries which were studied with reference to their desirability as breeding parents. A study of the inheritance of color of fruit indicates that several of the black raspberries are heterozygous for color and that probably several color factors are present. The same thing holds with the red raspberry though the higher number of yellows present would indicate fewer color factors. Glaucousness is considered a dominant character. Likewise rough bark is dominant to smooth bark. The factor for dwarfing appeared to be of rather rare occurrence.

Three of the seedlings of the purple raspberry Columbian produced some unusual abnormalities in the flower cluster, including gradations from perfect fruits to those in which the drupelets were replaced by small, sepal-like leaves, also fruits varying from perfect to entirely sterile forms which did not have the leafy growth. From a correlation which was found between leaf coloration and fruit it appears possible to tell all yellow raspberries from either the red or purple sorts by the absence of any tinge of red on the leaves. It is suggested that the bark of the young canes of the yellow varieties is also probably entirely lacking in any touch of red or purple color.

Notes are given on some crosses made between the flowering raspberry (*Rubus odoratus*) and the red raspberry, blackberry, and the dewberry. Of these crosses only those made with the Herbert red raspberry were brought to the blooming period.

Breeding raspberries, F. H. Hall (*New York State Sta. Bul. 417, popular ed. (1916), pp. 4, fig. 1*).—A popular edition of the above.

Notes on viticulture and enology, N. García de los Salmones (*Apuntes de Viticultura y Enologia. Pamplona, Spain: Author, 1915, pp. 929*).—The present work has been prepared as a text-book on viticulture and enology for use in the agricultural courses of the provincial school of Navarra, Spain, as well as a manual of information on the subjects for vineyardists and wine makers.

Some history of the grape in the United States, G. C. Husmann (*Trans. Mass. Hort. Soc., 1916, pt. 1, pp. 59–70*).—A brief historical review of the grape and wine industry in the United States.

Statistics on the production of grapes and olives in 1915 (*Estadistica de las Producciones Viticola y Olivarera en el Año 1915. Madrid: Govt., 1916, pp. 9*).—A statistical report on the production of grapes, wine, olives, and olive oil in various regions and Provinces of Spain during the year 1915.

Taming the wild blueberry, F. V. Coville (*Trans. Mass. Hort. Soc., 1916, pt. 1, pp. 103–123*).—The substance of this paper is contained in the author's bulle-

tin on blueberry culture (E. S. R., 34, p. 534) and the article previously noted (E. S. R., 35, p. 647).

The effect of organic matter on citrus growth, J. F. BREAZEALE (*Cal. Citrogr., 1 (1916), No. 11, pp. 7, 19, figs. 3*).—By way of summing up the evidence relative to the mosaic disease or mottling of citrus fruits, the author states that practically all investigators at the present time agree that mottling is one of the so-called soil troubles. The experience of the author, working with citrus water cultures and pot cultures, shows that an application of soluble organic matter, the so-called humus extracted from peat, decomposed alfalfa, and the like, even in minute amounts, 5 or 10 parts per million, will bring about a decidedly stimulating effect upon the citrus seedlings. These results, considered in connection with the soil types of the Riverside citrus area, led him to conclude that mottling may be rightly called malnutrition. It can be traced back to the root tip and is undoubtedly influenced in a large measure by the scarcity of organic matter in the soil.

California grapefruit, A. D. SHAMEL (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 7, pp. 239–249, figs. 4*).—This paper has been previously noted under another title (E. S. R., 34, p. 835).

Notes on coffee in Java, P. J. WESTER (*Philippine Agr. Rev. [English Ed.], 9 (1916), No. 2, pp. 120–132, pls. 7*).—This comprises extracts from a report to the Philippine Bureau of Agriculture on the coffee industry in Java and deals particularly with the kinds of coffee and the process of preparing coffee for market. Data on the cost of production are also given.

The germination of tea seed, C. BERNARD (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Proefstat. Thee, No. 43 (1915), pp. 30–88, pls. 6*).—In this paper the author describes the germination process of tea seed, and gives the results of some germination tests in which the seeds were sown with and without the hard shell, placed with the eye in different positions, and grown under different strengths of light.

The selection of the tea plant, III, P. VAN LEERSUM and C. BERNARD (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Proefstat. Thee, No. 43 (1915), pp. 1–29, pls. 3*).—This comprises a further report on experiments being conducted by the authors with the special object of developing through selection a race of tea better adapted to conditions in Java than the present forms (E. S. R., 30, p. 444). The results secured from germination tests of selected strains of seed are reported, and suggestions are given for conducting selection experiments.

Experience in top-working hickories, F. B. GUINN (*Amer. Fruits, 24 (1916), No. 2, p. 27*).—In this paper the author gives a brief account of his experience in top-working hickory trees with different varieties of pecans.

How to make a flower garden (*Harrisburg, Pa.: The Countryside Press, 1915, pp. 75, figs. 15*).—A small practical treatise.

Peonies, J. H. SPERRY (*Country Gent., 81 (1916), No. 34, pp. 1556. 1557, figs. 3*).—In this article the author discusses the general cultural treatment of peonies and gives a descriptive list of some of the best varieties of herbaceous Chinese peonies as observed during the season of 1916.

Roses of Denmark, S. ALMQUIST (*Bot. Tidsskr., 34 (1916), No. 6, pp. 257–287*).—An account of the rose flora of Denmark, including a classification of types and descriptions of species.

The white-barked pine, D. F. HIGGINS (*Jour. Heredity, 7 (1916), No. 9, pp. 399–401, figs. 2*).—A brief descriptive account and illustrations are given of the white-barked (*Pinus bungeana*), which is grown in China as an ornamental and has been introduced into the United States for trial by the U. S. Department of Agriculture.

Practical landscape gardening, R. B. CRIDLAND (*New York: A. T. De La Mare Printing & Publishing Co., Ltd., 1916, pp. 266, pl. 1, figs. 189*).—This work discusses the importance of careful planning; locating the house; arrangement of walks, drives, and entrances; construction of walks and drives; lawn making; ornamental planting of trees, shrubs, and flowers; architectural features of the garden; hardy borders; rose gardens; and wild gardens. Planting plans and planting keys are also included.

National system of highways and landscape designing, C. KEHR (*U. S. Senate, 64. Cong., 1. Sess., Doc. 350 (1916), pp. 12*).—An address delivered before the American Civic Association at Washington, D. C., on December 31, 1915, in which the author advocates a nation-wide system of highways, affording communication between major centers, which will not only be direct but will combine landscape effects with utility.

Garden writings in America, L. BARRON (*Trans. Mass. Hort. Soc., 1916, pt. 1, pp. 71–88*).—In this paper the author reviews the trend of contemporary American garden writings and publications, with special reference to their adaptability to gardening conditions in America.

FORESTRY.

Suggestions as to possibilities of silviculture in America, B. E. FERNOW (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 171–176*).—In this paper the author discusses the various factors which may influence the practice of silviculture in this country, and calls attention to the need of securing a more thorough knowledge relative to the principles of silviculture as applied to America.

The woodlot: Its present problems and probable future status in the United States, C. R. TILLOTSON (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 198–207*).—In this paper the author confines his discussion of the present woodlot problems to those which exist in the prairie and in the older settled, formerly timbered agricultural region of the Central States. The probable future status of the farm woodlot in the United States is also considered.

Forest taxation as a factor in forest management, G. W. HUTTON and E. E. HARPMAN (*Proc. Soc. Amer. Foresters, 11 (1916), No. 3, pp. 330–335*).—The present paper is based on a study of present tax methods in the State of Washington.

Hewn-tie versus saw-timber rotations, C. F. KORSTIAN (*Proc. Soc. Amer. Foresters, 11 (1916), No. 3, pp. 315–329*).—In this paper the author presents the results of a detailed study of the Rio Pueblo and Rio Santa Barbara watersheds of the Santa Fe National Forest. The object was to determine the class of product, rotation, and cutting cycle to be used in the future silvicultural management of these and similar areas. It is concluded in substance that economic conditions in these areas warrant the use of a short rotation sufficient for the production of hewn ties rather than a long rotation for the production of saw timber. A short rotation is also considered more desirable from the pathological standpoint.

Christmas tree plantations, A. K. CHITTENDEN (*Michigan Sta. Spec. Bul. 78 (1916), pp. 3–8, figs. 3*).—The results secured from an experimental Christmas tree plantation established by the department of forestry of the station in 1909 are reported.

The area devoted to the experiment was 0.28 of an acre. Four-year-old Norway spruce transplants were used, the trees being spaced 3 ft. apart in triangles at the rate of 5,584 trees to the acre. Tree removals were begun in 1913, when the largest trees were taken out. During this period the loss in area was

less than 2 per cent. From 1913 to 1915, inclusive, 750 trees were taken out, all of which could be disposed of to good advantage, and 800 trees were left for future sale.

With these growth rates as a basis estimates are given showing the probable cost and returns from such a plantation. Assuming an average price of 15 cts. per tree with a 5-year rotation the gross returns for 5,305 trees amount to $795.75. The cost of stock and planting plus 6 per cent for five years would be $165.94, leaving a net balance of $629.81. No allowance was made for occasional cultivations or harvesting, which is done during the winter months when work is slack. The experiment as a whole indicates that Christmas trees may be grown with profit as a farm crop in limited quantities, depending on the local demand and prices.

Hylobius pales as a factor in the reproduction of conifers in New England, E. E. Carter (*Proc. Soc. Amer. Foresters, 11 (1916), No. 3, pp. 297–307, figs. 2*).—Observations made by the author on various coniferous plantations in New England led to the conclusion that it is a waste of money to plant cutover pine lands during the first two seasons after cutting if the conifers most commonly planted in New England are used. Such plantations will be subject to heavy loss, in some cases amounting to almost complete destruction, by the beetle *H. pales*. This conclusion is in accordance with the practice in many parts of Europe, although the species and even the genera of both trees and insects are different from those in New England. It is suggested that if the advance growth of pine found in pastures or fields can not be removed two or more years in advance of making a coniferous planting on the land it would be better to leave the advance growth and make early thinnings to prevent the development of wolf trees.

The presence of this beetle adds to the difficulty of reproduction by the shelterwood method, inasmuch as the final cutting after the pine reproduction has started merely invites the destruction of the small trees by the beetles. If the strip method of reproduction is used, the intervals between the cutting of strips should be sufficiently long for the reproduction to have reached a height of 3 ft. or more before the timber on the next strip is cut.

Water requirements and growth of young cypress, W. R. Mattoon (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 192–197, figs. 3*).—Some experimental tests made with cypress seed and seedlings are reported.

The results indicate in general that in the early stages both the seeds and seedlings of cypress demand a very high degree of soil moisture, so that in its juvenile stages the species seems to be semiaquatic in habit. From these results it is recommended that cypress seed be soaked for a period of several weeks, probably from four to eight, preparatory to sowing, thus reducing the cost of starting the seedlings as compared with the usual method of frequent waterings in nursery beds continued for a period of from one to three months.

The various osiers cultivated in France and neighboring countries, E. G. Camus (*Vie Agr. et Rurale, 6 (1916), No. 32, pp. 95–98, figs. 7*).—The different species and varieties of willows used in osier culture in France and neighboring countries are described.

The early European history and the botanical name of the tree of heaven, Ailanthus altissima, W. T. Swingle (*Jour. Wash. Acad. Sci., 6 (1916), No. 14, pp. 490–498*).—A brief review of the literature relative to the Ailanthus in Europe, together with notes on its introduction into the United States and its importance as an ornamental and economic tree.

The English names of some trees, W. W. Ashe (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 233–239*).—In this paper the author calls attention to the

confusion in the use of English names for many of our trees and suggests the use of certain names for correcting this confusion to some extent.

A forest census of Alabama by geographical divisions, R. M. Harper (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 208–214, fig. 1*).—In the present paper the author divides the State of Alabama into ten geographical divisions, and gives a table showing for each of the ten regions and for the whole State the percentage of forests in 1910, the expenditure for fertilizer in 1909 per acre of improved land, the percentage of evergreens, and the percentage of the present forest made up by each species of tree.

Forests of Crater Lake National Park, J. F. Pernot (*U. S. Dept. Int., Off. Sec. [Pub.], 1916, pp. 39, figs. 25*).—A general account of the forest types in the Crater Lake National Park, including descriptions of forest species.

The administrative report of the Virginia state forester from March to December, 1915, inclusive, R. C. Jones (*Admin. Rpt. Va. State Forester, 1 (1915), pp. 48, figs. 8*).—A summary of activities for the above period, together with suggestions for extending the state forestry work and recommendations for amendments to the present forestry laws.

The growing stock as a criterion of normality, A. B. Recknagel (*Proc. Soc. Amer. Foresters, 11 (1916), No. 3, pp. 308–314, fig. 1*).—A brief comparison of methods of determining the normal growing stock in forests.

Top diameters as affecting the frustum form factor for longleaf pine, H. H. Chapman (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 185–191*).—A further discussion relative to the application of the frustum form factor method of constructing volume tables for different species of trees (E. S. R., 34, p. 641), including the results of some tests of the form factor method on longleaf pine in Alabama.

The factor of top diameters in construction and application of volume tables based on log lengths, H. H. Chapman (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 221–225*).—In this paper the author calls attention to the errors which are apt to be made in connection with the use of the top diameter in the construction and application of volume tables based on log lengths.

The Biltmore stick and the point of diameter measurements, D. Bruce (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 226–229*).—The author here presents data to show the extent of error which may arise in using the Biltmore stick (E. S. R., 25, p. 843; 31, p. 341) by taking the measurements at the wrong height.

Utilization of wood waste by chemical means, H. F. Weiss (*Proc. Soc. Amer. Foresters, 11 (1916), No. 2, pp. 177–184*).—In this paper the author briefly describes the chemical processes now established in the United States which utilize wood waste, gives the extent to which they are now commercially established, and discusses their future outlook for expansion.

DISEASES OF PLANTS.

[Plant diseases in Porto Rico], J. A. Stevenson (*Rpt. Bd. Comrs. Agr. P. R., 4 (1914–15), pp 33–44*).—This is a report of the pathologist covering the period from July 1, 1914, to June 30, 1915.

Citrus scab, ascribed most commonly to *Cladosporium citri*, has begun to attack grapefruit. Fruit rot, or mal di gomma, seems to be on the wane at present. A Fusarium, as yet undetermined as to species and parasitic character, has been found present in typical fruit rot cases, but proper drainage and use of stocks other than lemon are expected to eradicate the disease. Fruit rots causing considerable loss during the season are ascribed to such fungi as *Penicillium* spp. *Rhizopus nigricans*, *Aspergillus niger*, and *Diplodia*

natalensis. Blossom-end rot of oranges may be due to a Fusarium. A black rot, ascribed to *Alternaria citri*, is not regarded as of very great importance at this time. Citrus canker is not yet known to have been brought to Porto Rico from the neighboring mainland.

Cytospora sacchari is a comparatively new disease of sugar cane, the well marked symptoms of which are briefly described. Root disease of sugar cane is a trouble ascribed to a number of organisms readily attacking the native cane. All the organisms yield to the same treatment.

A mold of cigars was found to yield *Aspergillus* sp. (a blue-green form), *A. flavus*, *Cladosporium herbarum*, *Penicillium* sp., and *Fusarium* sp., all probably saprophytic in the material used to fasten the wrapper.

Prickly pear near the southern coast is attacked by a fungus, apparently *Diplodia opuntiæ*.

Leaf spot (*Cercospora citrullina*) of watermelon was noted near San Juan.

A defoliating leaf spot of cowpeas is referred to *C. vignæ*.

Parasitic Rhizoctonias in America, G. L. Peltier (*Illinois Sta. Bul. 189 (1916), pp. 281–390, figs. 23; abs., pp. 4*).—In connection with a serious stem rot of carnations due to Rhizoctonia, the author has conducted an investigation of the diseases of vegetable, field, and floricultural crops which are caused by Rhizoctonia, the primary object being to determine whether infection is brought about by one or more than one species of Rhizoctonia.

It is stated that there are recognized in America two species of truly parasitic Rhizoctonia, *R. solani*, which is widely distributed on a great number of hosts, and *R. crocorum*, which is at present limited in its distribution to alfalfa and potato tubers. A third species, *Corticium ochroleucum*, is found on leaves of pomaceous fruit trees, while a fourth species, isolated from damped-off onion plants, is considered of questionable parasitism.

So far, the author has found that about 165 species of plants have been listed as subject to attack by *R. solani*. This list includes most floricultural plants, vegetable and field crops, herbaceous plants, and many weeds. From inoculation experiments conducted with a large number of types of plants, the author concludes that all the strains studied can be included under the one form *R. solani*. These investigations show that the virulence of *R. solani* is very variable, as is also the degree of resistance of the various host plants. No marked specialization was noted in any of the strains of the fungus. A certain vigor of mycelium was found to be required before *R. solani* is able to attack the plant. A high temperature (88° F.), together with too little or too much moisture determines to a large degree the virulence of the different strains. This fungus is said to become a dangerous parasite only under certain conditions.

An extensive bibliography is given.

The susceptibility of grains to smuts and rusts, O. von Kirchner (*Fühling's Landw. Ztg., 65 (1916), Nos. 1, pp. 1–27; 2, pp. 41–72; 3–4, pp. 92–137*).—The results of tests with a very large number of varieties of different agricultural grains are detailed and tabulated as regards their susceptibility to rusts and smuts with a discussion of the various factors predisposing to attack. A bibliography is appended.

Resistance of wheat to rust, O. Comes (*Ann. R. Scuola Sup. Agr. Portici, 2. ser., 12 (1914), pp. 419–473*).—This statement deals with rusts and other parasitic injury to wheat as related to stock, breeding, locality, soil, seeding time, and sap constitution.

Treatment of winter wheat against Fusarium, Penicillium, and stinking smut, L. Hiltner (*Prakt. Bl. Pflanzenbau u. Schutz, n. ser., 13 (1915), Nos. 8,*

pp. 97–109, fig. 1; 9, pp. 113–124).—This continuation and conclusion of the report previously noted (E. S. R., 35, p. 651) records the results of work done in different localities during several years in testing winter wheat and rye as to the protective capability of several standard or commercial fungicides from which benefit was obtained.

Green vitriol (ferrous sulphate) as a preventive of take-all, G. P. DARNELL-SMITH (*Agr. Gaz. N. S. Wales, 27* (*1916*), *No. 2, p. 134*).—It is stated that a considerable amount of loss was caused last season to the wheat crops of New South Wales by take-all, due to *Ophiobolus graminis* attacking the roots.

Of the various remedies tried, the application of ferrous sulphate to the soil has given partial success, and it is recommended as a result of experiments that it be tested further at the rate of about 50 lbs. per acre. It is claimed that ferrous sulphate oxidizes the organic matter of humus, hastening its decomposition, that it fixes ammonia in the soil, that it aids the plant in absorbing phosphoric acid from the soil, and that even at nonfungicidal strengths it imparts vigor to the plant, enabling it to resist soil parasites.

Storage rots of economic aroids, L. L. HARTER (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 15, pp. 549–572, pls. 3, fig. 1*).—A report is given of a study of storage rots of a number of species and varieties of Colocasia, Alocasia, and Xanthosoma. These plants suffer in storage attacks of a number of rots, and in 1912 several organisms were isolated from diseased material and subsequent inoculation experiments were carried on with the organisms.

Four storage rots are described, Java black rot, found to be caused by *Diplodia tubericola*, *D. maclurœ*, *D. gossypina*, and *Diplodia* sp. from *Mangifera indica;* a powdery gray rot caused by *Fusarium solani;* Sclerotium rot caused by *S. rolfsii;* and soft rot caused by *Bacillus carotovorus*. All the organisms are wound parasites, and their parasitism was established by inoculation experiments. Relatively dry conditions favor attack by the Java black rot organism, while moisture was required for successful infection by the other organisms. High temperatures were more favorable to attack than low temperatures, *B. carotovorus* alone producing decay at an average temperature below 9° C. (48.2° F.).

Beets attacked by Cercospora beticola, E. SAILLARD (*Compt. Rend. Acad. Sci.* [*Paris*], *162* (*1916*), *No. 1, pp. 47–49*).—Sugar beets were visibly injured during 1915 by the presence of *C. beticola*, which was recorded from several regions in France. The crop was reduced both in quantity and in quality as regards sugar content and the presence of nitrogen compounds. In some ways the anomalies observed were similar to those noted for the dry year 1911. Tabulated results for 1907 and for 1909 to 1912 are given and for 1915 in greater detail.

New diseases of cucumber in Sweden, J. ERIKSSON (*Centbl. Bakt.* [*etc.*], *2. Abt., 44* (*1915*), *No. 1–4, pp. 116–128, figs. 10; abs. in Rev. Gén. Bot., 27* (*1915*), *No. 323, p. 351*).—A further account (E. S. R., 32, p. 641) is given of the history of the three fungi *Cladosporium cucumerinum*, *Cercospora melonis*, and *Colletotrichum lagenarium*.

Conditions favoring attack on cucumber by these fungi include breeding methods which produce weak or susceptible plants, and close and intensive culture, preventing the maintenance of hygienic conditions. Propagation is thought to occur possibly through the seedlings, involving a mycoplasm and a plasma stage similar to that claimed to be concerned in rust of cereals and mallows. Recommendations for control include frequent washings, aeration and soil renewal in the hot house, and the destruction of all plants not known to be free from infection.

Experiments with clean seed and potatoes on new land in southern Idaho, O. A. Pratt (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 15, pp. 573–575*).—In connection with investigations of potato diseases in southern Idaho, where the crop is grown under irrigation, the author had a chance to test the belief that newly reclaimed lands offer an opportunity for the production of disease-free potatoes. In this region the diseases most prevalent are wilt, due to *Fusarium oxysporum;* black rot, due to *F. radicicola;* jelly end rot, due to *Fusarium* sp.; Rhizoctonia disease; a powdery dry rot, due to *F. trichothecioides;* and common scab.

A preliminary report is given of experiments conducted in the spring of 1915 to determine whether, by planting disease-free seed on new land, a disease-free crop would be obtained. Plats on virgin soil as well as on land where alfalfa or grain had been grown for several years were planted, and at harvest time a number of tubers were examined.

The presence of disease in the plats in which grain or alfalfa had been previously grown was considerably less than the percentage of diseased tubers obtained on plats of recently reclaimed desert land. Planting clean seed potatoes on new land did not guarantee a disease-free product.

The disease of potatoes known as "leak," L. A. Hawkins (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 17, pp. 627–640, pl. 1, fig. 1*).—An account is given of an investigation, carried on in the delta region in the San Joaquin Valley of California, of the tuber rot of potato known as potato leak, which was formerly reported as due to *Rhizopus nigricans* (E. S. R., 20, p. 948). The investigations of the author corroborate the work previously described in part. However, another fungus was obtained 49 times out of 61 attempts, and a study made of this proved it to be *Pythium debaryanum.* Inoculation experiments with this organism produced a rot identical to all appearances with potato leak, and it is considered probable that this disease is produced by both *R. nigricans* and *P. debaryanum,* the latter being apparently more frequently the causal organism.

Infection is believed to take place in the field from infected soil getting into wounds made in digging, as no infection was observed in the field or in the laboratory where the skin of the tuber was unbroken. From the results of these experiments, it is believed that the disease may be controlled by more care in harvesting and handling the potatoes and the careful sorting out of wounded tubers.

Some properties of the virus of the mosaic disease of tobacco, H. A. Allard (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 17, pp. 649–674, pl. 1*).—In continuation of previous work (E. S. R., 30, p. 450), the author has described additional investigations on the virus of the mosaic disease of tobacco.

Evidence is presented to show that the infective principle can not be identified with peroxidase. The author claims that neither peroxidase nor catalase in the sap of diseased plants can be responsible for the mosaic disease. These enzyms are normally present in healthy plants, while the sap of such plants is without infectious properties. By evaporation of the enzyms present in healthy sap they may be brought to a high concentration, but such solutions never acquire infectious properties. On the other hand, the peroxidase content of mosaic sap may be diminished to such an extent that peroxidase reactions are no longer discernable, yet such solutions may remain highly infectious.

The author claims that neither enzyms nor any other normal constituent present in healthy sap is responsible for this disease, but that it is due to a particulate substance that is not a constituent of healthy plants. This pathogenic agent is highly infectious and is capable of increasing indefinitely within

susceptible plants, and, in the author's opinion, there is reason to believe that it is an ultramicroscopic parasite of some kind.

Mosaic disease of tobacco and tomatoes (*Gard. Chron., 3. ser., 59* (*1916*), *No. 1526, pp. 172, 173*).—This is a discussion of the report of Clinton regarding calico disease of solanaceous plants (E. S. R., 34, p. 52).

Armillaria mellea killing fruit trees (*Agr. Gaz. N. S. Wales, 27* (*1916*), *No. 1, p. 16*).—It is stated that a disease killing apple, peach, nectarine, plum, and other fruit trees has been found by E. Mackinnon to be caused by the honey fungus, *A. mellea*, previously noted (E. S. R., 33, p. 149) in connection with citrus trees.

If the parasite is found on the roots in the form of brown strands, all dead portions should be removed and the diseased areas scraped and treated with strong Bordeaux paste, made up of copper sulphate 1.5 lbs., quick lime 1 lb., and water 2 gal., and applied with a brush. Wounds should be dressed with Stockholm tar and the lower trunk and adjacent roots left exposed to the air from three to four weeks.

Spraying experiments and apple diseases in 1915, W. J. Morse (*Maine Sta. Bul. 252* (*1916*), *pp. 167–192, pls. 2*).—This bulletin gives an account of apple spraying experiments carried on for the prevention of apple scab, describes winter injury to trees set in dynamited holes, and discusses two apple-leaf troubles, chlorosis and silver leaf, which are said to be new in Maine, and the overwintering of the apple-scab fungus on apple twigs.

The work on spraying is in continuation of a series of experiments which have been in progress for a number of years, and a summary of the results has already been given (E. S. R., 35, p. 549). In 1915, the scab developed to such a slight extent on the experimental plats even where no spray was applied that the results are considered less conclusive than in previous years. The application of Bordeaux mixture in connection with arsenate of lead resulted in considerable russeting of the fruit. The highest percentages of perfect apples were obtained from those trees which received a blossom bud application of a rather strong lime-sulphur solution to which lead arsenate was added, followed by two applications of lead arsenate, and from trees which were treated with lead arsenate alone. The application of dormant strength lime-sulphur after the leaf buds had begun to open, but at a time when the flower buds were still thoroughly protected, increased the amount of fruit russeting in a way that does not seem to be readily explained. The author, as a result of his investigations, does not consider the applying of dormant sprays later than usually recommended for use against scale and similar insects as of advantage from the standpoint of scab prevention.

An account is given of winter injury to Baldwin apple trees set in dynamited holes, comparison being made with those planted in dug holes. The trees were planted in 1913 in a soil having a hardpan subsoil, and in 1915, out of 126 trees set in holes previously dynamited, 49 were either winterkilled or badly injured, while of 52 trees set in shovel-dug holes, only 4 suffered in a like manner. No attempt is made to draw general conclusions from these figures, but it is believed that the method of setting trees in dynamited holes is not adapted to soil conditions at the Maine Station.

Two apple-leaf troubles new to Maine are described, a chlorosis in which the leaves are variously spotted or mottled with irregular splotches of yellow, and a silver leaf which had been previously reported in Europe but had not been observed in Maine. The cause of the chlorosis has not been definitely determined, nor has the author been able to confirm the connection between silver leaf and the occurrence of *Stereum purpureum*. This fungus was not

observed on any of the trees, although it is known to follow winter injury to apple trees in Maine.

Some further observations are given relative to the ability of the apple-scab fungus to live over the winter on young twigs, confirming and extending those previously noted (E. S. R., 30, p. 542). Specimens were observed in 1914 and 1915 indicating that the disease was carried over in the young twigs, and in 1916 these observations were extended to include scab infections on pear limbs.

The treatment of peach leaf curl, C. GANDOLFI (*Coltivatore, 61 (1915), No. 14, pp. 435–437; abs. in Internat. Inst. Agr.* [*Rome*], *Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 7, p. 1000*).—Experiments carried out for several years in northern Italy showed complete freedom from peach leaf curl in case of trees which were covered with muslin nets, while trees left uncovered but sprayed with Bordeaux mixture late in November and again about the middle of February were attacked. A glass roof also gave freedom from leaf curl. The method of protection with muslin is said to assure a practically constant setting of the fruit.

The 1915 outbreak of downy mildew in France and Italy, J. PASTRE (*Prog. Agr. et Vit. (Ed. l'Est-Centre, 37 (1916), No. 16, pp. 368–380; abs. in Rev. Sci.* [*Paris*], *54 (1916), I, No. 10, p. 313*).—A résumé is given of observations, opinions, and conclusions resulting from the investigations of the Central Society of Agriculture of Herault regarding the severe and extended outbreak of mildew in 1915, which copper sprays very frequently failed to check in the usual manner.

The date of treatment is regarded as extremely important. The time of greatest susceptibility to infection appears to be the blooming period. The violence of the 1915 outbreaks is thought to have been due to the multiplication of spores in 1914, lack of vigilance and proper treatment on account of the war, and abundant rains in May, 1915, with high temperatures, dews, and fogs late in May and early in June when the vines were in bloom, to which should be added, it is thought, a certain tolerance established for the copper sprays by the parasitic fungus. Attack by *Glœosporium nervisequum*, said to precede usually the mildew of grapes, is said to have been wanting in 1915. Exceptions are noted also as regards the behavior of varieties ordinarily immune or nearly so to mildew.

The various treatments tested in Italy and France are detailed in separate tables, according to their results as good or bad. The several treatments which have been recommended or are in use are discussed in some detail as regards their composition, preparation, and application.

Downy mildew, its manifestations and directions for its control, L. RAVAZ (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 15, pp. 341–347*).—A summation is given of known facts regarding the times, conditions, and modes of attack and development of downy mildew, which has recently been severe on grapevines in parts of France, also regarding measures looking to its control.

Cupro-ferric sprays for downy mildew and chlorosis, A. DONADIEU (*Prog. Agr. et Vit. (Ed. l'Est-Centre), 37 (1916), No. 10, pp. 224, 225*).—The author states that grapevines persistently showing chlorosis in a fertile but low and basin-shaped area recovered and continued free from mildew and chlorosis, healthy, and productive from 1912 to 1915 as a result of the adoption of a combined spraying liquid for the foliage. This spray was made up by adding to a previously prepared Burgundy mixture sufficient iron sulphate (previously dissolved in a little water) to give a strength of 0.1 per cent of this salt. The preparation should be acid and should be applied early but sparingly to avoid scorching.

Cupro-ferric sprays for downy mildew and chlorosis, A. Donadieu (*Prog. Agr. et Vit.* (*Ed. l'Est-Centre*), *37* (*1916*), *No. 12*, *pp. 271, 272*).—Responding to inquiries regarding the treatment above mentioned, the author gives the formula employed. This requires 2,000 gm. copper sulphate and from 750 to 800 gm. sodium carbonate in 100 liters of water, with the addition, when the above has been properly made up, of 100 gm. iron sulphate.

Treatments for downy mildew and the preparation of copper sprays, L. Degrully (*Prog. Agr. et Vit.* (*Ed. l'Est-Centre*), *37* (*1916*), *No. 14*, *pp. 317–324*).—Enlarging on the statement that the experience of 1915 showed that copper does not necessarily constitute an ideal remedy for mildew, at least under the usual forms and conditions recently found in actual practice, the author discusses the great influence of the time factor as related to outbreaks; the duration of the effectiveness of one spraying (in 1915 not over four to five days); the suitable preparation of sprays and the proper dosage thereof; the acid, alkaline, neutral, and casein preparations of Bordeaux and several other preparations. It is stated that in regions severely attacked in 1913 to 1915 only those grape growers saved their entire product who employed treatment without intermission throughout the whole of the danger period.

Mottle leaf of citrus trees in relation to soil conditions, L. J. Briggs, C. A. Jensen, and J. W. McLane (*U. S. Dept. Agr., Jour. Agr. Research*, *6* (*1916*), *No. 19*, *pp. 721–740*, *pls. 3*, *figs. 4*).—The authors report a study of the cause of mottle leaf of citrus trees which is characterized by the disappearance of the chlorophyll of parts of leaves. The principal conclusion of their investigation is that the mottling of orange trees in the areas studied is definitely correlated with a low humus content of the soil, the mottling diminishing as the humus content increases. It is claimed that approximately one-half of the mottling can be accounted for in this way and that the incorporation of organic matter with the soil in such a manner as to be readily accessible to the roots during its decomposition is a promising treatment for this trouble.

Fighting a fungus, Pythiacystis citrophthora, in the citrus orchards, H. S. Fawcett (*Univ. Cal. Jour. Agr.*, *3* (*1916*), *No. 8*, *pp. 339–343*, *356 figs. 3*).—The fungus *P. citrophthora*, isolated and described by Smith in 1906 as the cause of brown rot of lemons (E. S. R., 19, p. 658) and shown by the present author in 1913 (E. S. R., 30, p. 51) to cause also a form of gummosis in the bark, is here discussed as to the conditions, modes, and consequences of its attack, and as to its control.

Bordeaux mixture as a spray is deemed practically preventive, as is also fresh Bordeaux paste in connection with surgery when the trunk is attacked, which usually occurs near the surface of the ground. Sour orange is very resistant and desirable to use for stocks. These should, however, be budded high and so planted as to keep the bud unions as far as possible from the surface of the ground.

A serious disease of cultivated perennials caused by Sclerotium rolfsii, G. L. Peltier (*Illinois Sta. Circ. 187* (*1916*), *pp. 4*, *fig. 1*).—It is stated that during the summer of 1915 a large number of perennial ornamental plants were found dying from crown rot. An investigation of the disease showed that it was due to the fungus *S. rolfsii*. The disease is said to have made its first appearance in July and to have killed a large number of plants during the warm weather. It persisted until late in October, although with cooler weather the attack became less severe. Among the ornamentals attacked were several species of Campanula, Phlox, Dianthus, Eupatorium, etc. The outbreak of the disease is attributed to the extremely wet summer, and it is considered doubtful whether, under normal conditions, the disease will ever become serious in Illinois.

Two timber-destroying fungi, J. B. Cleland and E. Cheel (*Agr. Gaz. N. S. Wales, 27 (1916), No. 3, pp. 201, 202, pls. 2*).—Descriptions are given of fungi which cause tree rots of economic importance.

Pleurotus nidiformis, a variable species which has received different names, is a common phosphorescent toadstool found near the bases of Eucalyptus and other trees in each of the Australian States. *Pholiota adiposa*, a common and supposedly destructive parasite of timber in Europe, has been found at Mount Wilson in New South Wales and has been recorded also for Queensland.

Anomalies of growth in Pinus, C. von Tubeuf (*Naturw. Ztschr. Forst u. Landw., 13 (1915), No. 11-12, pp. 550-555, figs. 3*).—Descriptions are given of an anomalous shoot arrangement and bud formation and of a cone disease in *P. sylvestris*.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Ground squirrel control, W. T. Shaw (*Washington Sta. Popular Bul. 99 (1916), pp. 11, pls. 2, figs. 4*).—The station has given attention to the habits and means of controlling three species of ground squirrels, the Columbian ground squirrel (*Citellus columbianus*), Townsend ground squirrel (*C. townsendi*), and Yakima ground squirrel (*C. mollis yakimensis*).

Careful life history studies have been made of the Columbian ground squirrel, and have shown that the squirrels come out of hibernation at Pullman, Wash., about February 20 and remain active until July. The burrowing and feeding habits of the animals indicate quite clearly that all remedies for controlling them may be applied with more success during the first nine weeks of their spring activity. The remedies which have given satisfactory results during this time include carbon bisulphid, trapping, and the use of poisoned grain. Detailed directions for applying these remedies are given.

Important foreign insect pests collected on imported nursery stock in 1915, E. R. Sasscer (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 216-219*).—This is a summary of the results of inspection work in 1915.

Inspection facilities in the District of Columbia, E. R. Sasscer (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 219-223, pls. 3*).—A description of the inspection equipment.

Foreign pests recently established in New Jersey, H. B. Weiss (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 212-216*).—A considerable number of insects which have been discovered during the past two years to have become established in varying numbers in different parts of New Jersey are here recorded. It is stated that practically all were introduced on imported nursery stock, and their presence is considered an indication of the impossibility of keeping out all foreign pests by a system of inspection.

On the Hawaiian work in introducing beneficial insects, L. O. Howard (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 172-179*).—A review of the work carried on in the Hawaiian Islands.

Results of experiments on the use of cyanid of potassium as an insecticide, W. Wellhouse (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 169-171. pl. 1*).—A report of preliminary experiments, conducted with the view of ascertaining the effect of cyanid of potassium on plant tissues and on scale insects and borers, begun in 1915. Severe injury was found to follow its insertion in the stems and trunks of plants and trees, and the insects were unaffected.

Proceedings of the Entomological Society of British Columbia (*Proc. Ent. Soc. Brit. Columbia, n. ser., No. 5 (1915), pp. 79-98, pls. 4*).—The papers here presented include the following: A Note on the Occurrence and Significance of Anophelinæ in British Columbia, by S. Hadwen (pp. 81, 82); Aphid Notes

from British Columbia, by H. F. Wilson (pp. 82–85); Notes on the Early Stages of *Calocampa cineritia*, by G. O. Day (pp. 86, 87); A Description of the Egg and Ovipositor of *Cuterebra fontinella*, the Cotton-tail Bot, by S. Hadwen (pp. 88–91); Notes on the Habits of Some Lepidoptera, by J. W. Cockle (pp. 91–94); Notes on the Early Stages of *Epirrita dilutata*, by G. O. Day (pp. 95, 96); and The Oyster Shell Scale, by T. Wilson (pp. 96, 97).

Some insect enemies of shade trees and ornamental shrubs, M. W. BLACKMAN and W. O. ELLIS (*N. Y. State Col. Forestry, Syracuse Univ. [Pubs.], 16 (1916), No. 26, pp. 123, pl. 1, figs. 60*).—A summarized account of six of the more important leaf-eating insects, eleven boring insects, and ten scale insects (pp. 11–112) is followed by an account of spraying and spraying apparatus.

Insects in their relation to the chestnut bark disease, F. C. CRAIGHEAD (*Science, n. ser., 43 (1916), No. 1100, pp. 133–135*).—This is a critical review of the bulletin by Studhalter and Ruggles, previously noted (E. S. R., 34, p. 853). It is pointed out that the beetle *Leptostylus macula*, which the above-mentioned authors state is the insect of most importance in the local dissemination of the disease, under normal conditions never frequents healthy trees, and that to disseminate this disease it would be necessary for the beetle to migrate from infested to healthy trees.

Controlling the coulee cricket, A. L. MELANDER (*Washington Sta. Popular Bul. 101 (1916), pp. 3*).—The means of combating this pest are briefly described. It is said to be easily possible to locate the restricted breeding areas and to destroy the young crickets.

A new species of Thripoctenus, L. T. WILLIAMS (*Psyche, 23 (1916), No. 2, pp. 54–61, fig. 1*).—Under the name *Thripoctenus nubilipennis* the author describes as new a form found to parasitize the larvæ of either one or both of two species of thrips, *Megalothrips spinosus* and *Cryptothrips rectangularis*, at Forest Hills, Mass.

The false cabbage aphis (Aphis pseudobrassicæ), J. J. DAVIS and A. F. SATTERTHWAIT (*Indiana Sta. Bul. 185 (1916), pp. 915–939, figs. 7; pop. ed., pp. 4*).—This plant louse, an account of which by Paddock of the Texas Station has been previously noted (E. S. R., 34, p. 452), is said to be distributed from Manitoba to Texas and from Massachusetts to California, apparently occurring in potential numbers wherever wild mustard grows, and to be destructively abundant where turnips or radishes are planted. It may also become a serious enemy of greenhouse crops.

The present bulletin is based upon life-history studies commenced in October, 1913, and carried on during 1914 at La Fayette, Ind., in cooperation with the Bureau of Entomology of the U. S. Department of Agriculture.

Technical descriptions are given of the five instars of the viviparous generation and of the winged viviparous female. Studies of its life history and habits reported in detail include tables which show the consecutive generations observed at La Fayette, Ind., from 1913 to 1915, and a figure showing the duration of generations. A comparison shows this plant louse to be more prolific than any other recorded species, thus indicating its great importance as an enemy of cruciferous plants.

Its natural enemies apparently do not appear in effective numbers until late in the fall after the plant lice have damaged the crop. *Diaeretus rapæ* and *Pachyneuron micans* have been reared from it by the authors, and *Aphidoletes* sp. and a syrphid larva have been observed to be predacious on it. *Empusa aphidis* is also an important check in late fall.

Control measures consist in the use of a 40 per cent solution of nicotin at the rate of 1:1,200, with 4 lbs. of soap to each 50 gal. of water. In greenhouses

this treatment may be used, or fumigation with hydrocyanic acid gas, directions for the use of which are given.

The western wheat aphis (Brachycolus tritici), J. R. PARKER (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 182–187, pl. 1*).—This aphidid, described by Gillette from Colorado in 1911, first attracted attention in a few localities in Fergus County, Mont., in 1910. In this year an investigation of the reports of injury led to the determination of the fact that it was causing serious injury to winter wheat. In one instance, a grower who had 700 acres of wheat estimated his loss at 5,000 bu., while 80 acres of wheat on another farm were so badly injured that no attempt was made to harvest it. Since 1910 the western wheat aphis has become increasingly abundant in Fergus County and has appeared in injurious numbers in several other counties.

This paper presents descriptions of the pest and discusses the character and extent of injury, seasonal history and habits, and control measures. Barley is said to be the only grain crop besides wheat thus far known to be injured by the wheat aphis. Blue joint grass (*Agropyron occidentale*) when growing in and around the edges of infested wheat fields is always heavily infested and is probably the native host plant.

Plant lice injurious to apple orchards.—I, Studies on control of newly hatched aphids, P. J. PARROTT, H. E. HODGKISS, and F. H. LATHROP (*New York State Sta. Bul. 415 (1916), pp. 11–53, pls. 8, figs. 6*).—The experiments and observations quoted in this bulletin were made chiefly at Geneva, but auxiliary experiments were carried on with more than 400 trees in 10 orchards in Niagara and Orleans counties. The work was chiefly concerned with control methods on newly hatched aphids. For this purpose lime-sulphur, nicotin solution, sodium sulphid mixed with soap, crude carbolic emulsion, and other insecticides were used. Observations were also made on the seasonal behavior of apple aphids and on the influence of these insects on the growth of apples. The species of plant lice under observation were *Aphis sorbi, A. avenæ,* and *A. pomi.*

The rosy aphis (*A. sorbi*) was chiefly responsible during 1915 for the dwarfing and deforming of apples. The effects of the other two species were not so clearly distinguished. The rosy aphis caused a retardation of increase in the transverse diameter of apples at first, but ultimately brought about a reduction of the axillary diameter of the fruit. Infested apples showed an average axillary diameter of 1.51 in. and transverse diameter of 1.71 in., as contrasted with 2.37 and 2.87 in., respectively, for the diameters of uninfested apples.

Satisfactory results in controlling the rosy aphis were obtained from the use of nicotin solution and soap, nicotin solution and lime-sulphur, and crude carbolic-acid emulsion. The first insecticide caused no injury to foliage, while slight injuries resulted from the use of the other two. The insecticides used in this experiment were equally efficacious against the other species of insects, but the multiplication of green aphis made repeated applications necessary to control this species. Evidence was obtained that the soap and nicotin solution brings about only a temporary protection. The value of the insecticide appeared to be enhanced by the addition of large amounts of lime.

Apple aphids and their control, F. H. HALL (*New York State Sta. Bul. 415, popular ed. (1916), pp. 11, figs. 2*).—A popular edition of the above.

Some grass-feeding mealy bugs, T. D. A. COCKERELL (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 312, 313*).—*Pseudococcus timberlakei* on salt marsh grass at Millbrae, Cal., and *P. neomexicanus utahensis* from Elymus at Salt Lake City, Utah, are described as new to science.

California green lacewing fly, V. L. WILDERMUTH (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 14, pp. 515–525, figs. 7*).—A report of studies of

Chrysopa californica carried on during 1915 in southern Arizona, where it is of considerable importance, particularly as an enemy of aphids. The species is known to occur throughout the Pacific Coast States and in Texas, Arizona, New Mexico, Nevada, Utah, and southern California. In addition to plant lice it feeds upon mites, leaf hoppers, thrips, etc.

Oviposition requires from one to four days, during which time about 30 eggs are deposited. From 6 to 12 days were passed in the egg stage, 8 days being the average for 122 eggs observed. From 11 to 22 days are required for the development of larvæ, 16 days being the average, during the course of which there are two molts and from 74 to 160 full-grown aphids were eaten by each larva. The pupal stage was found to vary from 14 to 23 days in length, the average being $16\frac{1}{3}$ days for March and $20\frac{7}{11}$ days for November. The author's observations show that there are at least six generations annually in the Salt River Valley.

Though reported to be commonly attacked by parasites in California, examinations of abundant material failed to detect any in Arizona.

Larval characters and distribution of two species of Diatræa, T. E. Holloway (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 16, pp. 621–626, pl. 1, fig. 1*).—The differences in the larval characters of *Diatræa saccharalis crambidoides* and *D. zeacolella* are pointed out and descriptions given of full-fed larvæ of both the summer and winter forms of the two species.

The food plants and breeding habits of the two have been found to differ to some extent. *D. saccharalis crambidoides* feeds on sugar cane, corn, and Johnson and other grasses, practically all the larval period being spent within the stalks of the plants, except that the first instars feed about on the leaves. *D. zeacolella*, however, seems to have a preference for corn even when sugar cane is present and goes down in the taproots of corn, which *D. saccharalis crambidoides* does not do. The last mentioned form has been found to be limited to southern Florida, southern Louisiana, and the southern tip of Texas, indicating that it was brought to this country in shipments of sugar cane from the Tropics.

Notes on the life history of Ecpantheria eridanus, R. H. Van Zwalenburg (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 1–3, pp. 12–17*).—This arctiid moth (*E. eridanus*, of which *E. icasia* is a synonym) is said to be fairly common throughout the island of Porto Rico and to have a wide variety of host plants. It has been taken on the orange, *Erythrina micropteryx*, *Ipomœa* sp., vanilla, banana, *Cissus* (?) *sicyoides*, and *Panicum* sp. At the experiment station the larvæ have done some damage by feeding on the blossom buds of vanilla. The synonymy of *E. eridanus* and *E. icasia* is said to have been substantiated by breeding both forms.

Technical descriptions of the adult and immature stages, including eight larval stages, are given. The eggs are deposited in large irregular clusters on the upper leaf surface, unfertilized females in captivity having each laid over 500 sterile eggs. From 6 to 8 days are required for the development of the egg, 24 to 62 days for the completion of the larval stages, and 15 to 20 days for the pupal stage. The ichneumon *Eremotylus angulatus* is said to parasitize the larvæ.

The army cutworm in Montana, R. A. Cooley and J. R. Parker (*Montana Sta. Circ. 52 (1916), pp. 97–108, figs. 4*).—Information previously noted (E. S. R., 33, p. 654) is supplemented by observations in 1915, when a state-wide outbreak of the army cutworm (*Chorizagrotis agrestis*) resulted in the destruction of at least 100,000 acres of grain, principally winter wheat. Notes by A. Atkinson on crops to plant where winter wheat has been destroyed are appended.

Notes on the relation of insects to the spread of the wilt disease, H. W. Allen (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 233–235*).—Very little is known

as to how the causative agent of wilt disease of the gipsy moth is spread. It apparently is not essentially a wind-borne disease. Certain insects occurring abundantly in association with the disease frequent the foliage of trees, and were found to carry polyhedra after contact with the wilt, which indicates that they may assist in spreading the infection.

Observations of the pine spinner in the greater coniferous forests in Neustadt-an-der-Warthe, 1913–14, SEITNER (*Centbl. Gesam. Forstw., 41 (1915), No. 5–6, pp. 161–173, figs. 5*).—A report of observations of the biology, parasitism, etc., of *Gastropacha pini* during the course of an outbreak of the pest in 1913–14.

Four European Diptera established in North America, F. KNAB (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 1–3, pp. 1–4*).—The author's study tends to show that *Pegomya vicina* of Lintner is a synonym of *P. hyoscyami.* This pest appears to be widely distributed in North America, probably occurring wherever the sugar beet is cultivated, since it is known to range as far south as Washington, D. C., in the East and into southern California in the West.

Hydrotæa meteorica is said to be abundant and troublesome to cattle in Montana, and is also known to occur in Colorado and North Dakota. The borborid *Leptocera sylvatica* is recorded from Arlington, Va.

The hippoboscid *Lynchia maura*, a common parasite of the domestic pigeon in the Mediterranean region, is said to have been collected from this host at Key West, Fla. It is also recorded as occurring in Iowa, Georgia, Cuba, Brazil, and Venezuela, and has recently made its appearance and become very common on pigeons in Hawaii.

Tanypezidæ in the United States, F. KNAB and R. C. SHANNON (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 1–3, pp. 33–36*).

A revision of the nomenclature of Indian Anophelini, S. R. CHRISTOPHERS (*Indian Jour. Med. Research, 3 (1916), No. 3, pp. 454–488*).—This paper, relating to the malarial mosquitoes, deals with some 38 species. It includes a table for their separation and a list of references to systematic work on the species and to the transmission of malaria by particular Indian species.

An Indian tree-hole breeding Anopheles, A. barianensis (Coelodiazesis plumbeus), S. R. CHRISTOPHERS (*Indian Jour. Med. Research, 3 (1916), No. 3, pp. 489–496, pl. 1*).—The author reports observations of the breeding habits of this species, previously unknown, and gives descriptions of the immature stages.

Anopheles crucians, their infectibility with the parasites of tertian malaria, M. B. MITZMAIN (*Pub. Health Rpts. [U. S.], 31 (1916), No. 12, pp. 764, 765*).—"In the course of a series of infectivity experiments with *A. punctipennis*, conducted in New Orleans, 19 specimens of *A. crucians* were fed simultaneously, February 6 and 7, 1916, on the blood of an individual suffering from tertian malarial fever. Examination of the blood of this case showed large numbers of asexual parasites and but few mature gametocytes. . . . The 38 specimens of *A. punctipennis* used in parallel feedings from the same case serve as a control series, 11 of these becoming infected from the sixth to the sixteenth day after biting; in 6 of these the salivary glands were extensively invaded with sporozoites. Two specimens of *A. quadrimaculatus* used under the same conditions as the foregoing remained negative throughout the course of the experiment."

An investigation of the supposed immunity of some varieties of wheat to the attack of Hessian fly, L. HASEMAN (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 291–294*).—The author concludes from the data presented that some varieties of wheat are more severely attacked by the fly than others.

Summary of facts about the introduction of Pleurotropis epigonus, W. R. McConnell (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 145–147*).—This article records the rearing of this parasite of the Hessian fly, first introduced from England in 1891, at Hagerstown, Md., and at several localities in Pennsylvania.

Parasitism among the larvæ of the Mediterranean fruit fly (Ceratitis capitata) in Hawaii during 1915, E. A. Back and C. E. Pemberton (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 306–311*).—The authors present tables to show the percentage of parasitism among *C. capitata* larvæ developing in coffee cherries (*Coffea arabica*) in the Kona District, in kamani nuts (*Terminalia catappa*) in Honolulu, and in various host fruits grown in Honolulu. The data for 1914–15 show that four introduced parasites, *Opius humilis, Diachasma tryoni, D. fullawayi,* and *Tetrastichus giffardi,* have established themselves and are already promising much as a factor in the control of the fruit fly.

Further notes on Prospaltella berlesei, L. O. Howard (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 179–181*).—A further review of the beneficial work of this parasite in Italy (E. S. R., 34, p. 456).

Designations of muscoid genotypes, with new genera and species, C. H. T. Townsend (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 1–3, pp. 4–12*).

Elucidations of New England Muscoidea, C. H. T. Townsend (*Insecutor Inscitiæ Menstruus, 4 (1916), No. 1–3, pp. 17–33*).

The life history of Hæmatobia sanguisugens, J. L. Mitter (*Indian Jour. Med. Research, 3 (1916), No. 3, pp. 530–537, pl. 1*).—This reports studies of the biology of this Indian species of bloodsucking muscid.

[The hickory bark beetle and the two-lined chestnut borer] (*U. S. Dept. Agr., Bur. Ent., [Work of the Insects That Are Killing the Hickories and Oaks], 1916, pp. 4, figs. 2*).—This leaflet calls attention to the destruction of hickory trees being caused by the hickory bark beetle and of oak trees by the two-lined chestnut borer on Long Island and gives remedies therefor.

A progress report on white grub investigations, J. J. Davis (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 261–281, pls. 3*).—This report is based upon investigations of Lachnosterna commenced at La Fayette, Ind., in 1911. Eighteen species of white grubs are said to have been reared from egg to adult and adults of nine more will have been reared from eggs by another year. The present paper gives a brief summary of life history studies, comparison with related genera, field observations, natural enemies, and methods of control.

Lachnosterna records in Wisconsin, J. G. Sanders and S. B. Fracker (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 253–261, figs. 3*).—Trap light collections of Lachnosterna at five stations in as many counties in the southern third of the State are reported upon. Seventeen of 19 species known to occur in Wisconsin were taken in the traps.

A study of the life history of the maize billbug, W. P. Hayes (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 120–130, pls. 3, fig. 1*).—A report of studies of *Sphenophorus maidis* made in southern Kansas during the seasons 1914 and 1915.

The European species of Diprion (Lophyrus), E. Enslin (*Naturw. Ztschr. Forst u. Landw., 14 (1916), No. 1, pp. 1–20, pl. 1*).—A synopsis of the European forms of this important genus of sawflies.

Further notes on Diprion simile, W. E. Britton (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 281, 282*).—This paper is supplementary to the account previously noted (E. S. R., 35, p. 54).

New Encyrtidæ from North America, A. A. Girault (*Psyche, 23 (1916), No. 2, pp. 41–50*).—The new forms of economic importance include *Signiphora thoreauini* from *Aspidiotus hederæ,* at Santa Barbara, Cal.; *Neosigniphora*

elongata from a coccid on Muehlenbergia, at Elk Point, S. Dak.; *Aneristus oculatipennis*, reared from the black scale, at Catacaos, Peru; *Formicencyrtus thoreauini* (n. g.) from *Coccus confusus*, at Mesilla Park, N. Mex.; *Zaommoëncyrtus submicans* (n. g.) from *Nyctobates pennsylvanica*, at Shiremantown, Pa.; *Ceraptroceroideus cinctipes* (n. g.) from *Aspidiotus helianthi* on *Eugerion canadense*, at Wellington, Kans.; *Berecyntus bakeri gemma* from Euxoa larva, at Queensboro, Ont., and also from larva of *Hadena devastatrix*, at Ottawa, Canada; and *B. bakeri arizonensis* from *Choraxagrotis* sp., at Phoenix, Ariz. The author also records the rearing of *S. flavopalliata occidentalis* from *Chrysomphalus aurantii citrinus* at Avondale, Cal.

The Argentine ant: Distribution and control in the United States, E. R. Barber (*U. S. Dept. Agr. Bul. 377 (1916), pp. 23, fig. 5*).—This bulletin includes the results of studies carried on in continuation of those by Newell and Barber, previously noted (E. S. R., 29, p. 563).

The pest has continued to spread and is now known to occur in nine southern States, the many infestations covering a total area of considerably more than a thousand square miles. At the time of writing it was known to occur from Houston, Tex., on the west to Wilmington, N. C., on the east, and from Nashville, Tenn., to the mouth of the Mississippi River. Among other cities known to be infested are Shreveport, La., Texarkana, Ark., Memphis, Tenn., Augusta and Atlanta, Ga., and Charleston, S. C. This wide distribution appears to have taken place with commodities shipped by steamboats and railroads.

The greater part of the bulletin deals with repression, particularly with ant poisons, of which the only effective ones for permanent control are poisoned sirups. Experiments have led to the recommendation of an improved formula said to be superior to any yet tested on account of its stability at high temperatures, freedom from crystallization, and continued attractiveness. This sirup, proposed by W. E. Cross, is prepared as follows: Granulated sugar 15 lbs., water 7 pints, tartaric acid (crystallized) ¼ oz., boil for 30 minutes, allow to cool. Dissolve sodium arsenite (C. P.) ¾ oz. in 1 pint of hot water and cool. Add the poison solution to sirup, stir well, add 1.5 lbs. honey, and mix thoroughly.

A new method of subterranean fumigation, J. S. Houser (*Jour. Econ. Ent., 9 (1916), No. 2, pp. 285–287*).—The author reports preliminary experiments conducted at the Cuban agricultural experiment station with the fungus growing ant *Atta insularis*. The principle of the method of control consists in forcing vaporized carbon bisulphid into the ant hills.

Some difficulties in gross diagnosis of the infectious brood diseases of bees, A. H. McCray (*Jour. Econ. Ent., 9 (1916), No. 1, pp. 192–196*).—This is a discussion of some of the difficulties which have been encountered in the examination of over 4,500 different specimens of bee comb and brood, representing every section of the United States.

FOODS—HUMAN NUTRITION.

The iodin content of foods, E. B. Forbes, F. M. Beegle, et al. (*Ohio Sta. Bul. 299 (1916), pp. 487–546*).—This bulletin presents data regarding the iodin content of a large number of samples of different foods. The investigation was undertaken on account of the rôle of iodin in the function of the thyroid gland and the possible significance of the iodin content of food in goiter.

Iodin determinations were made on a large number of common foods purchased in the market, and also on samples of the same kinds of food products grown under various conditions as to soil, climate, artificial fertilization, and geographical location. A wide range of both animal and plant products was in-

cluded in the study. The method employed was found to be accurate to 0.000003 gm. of iodin. The results of the experiments are presented in three tables as follows: An alphabetical list of the foods, showing the number of samples analyzed, the number containing iodin, and the maximum iodin content; a grouping of the foods according to their general class or characteristic; and a grouping of the foods according to geographical location of the source of the samples.

The following groups of foods are arranged in the order of increasing abundance of iodin, the first mentioned being that in which it is most rarely found: Nuts; spices, condiments, and stimulants; fruits; cereals; hays, silage, and forage crops; garden vegetables and root crops; leguminous seeds; animal products; manufactured foods and milling and manufactory by-products; and seaweeds. It was usually found in exceedingly small quantities, is by no means a constant constituent of foods, and is deemed, in most cases at least, strictly an accidental constituent.

Traces of iodin were found in butter, in eggs, and in several kinds of meat and fish, but none was found in 18 samples of cow's milk. Among the garden vegetables and root crops traces of iodin were found in beets, cucumbers, celery, onions, potatoes, and spinach.

"Of the hays, silage, and forage crops about 1 sample in 4 contained iodin. Among leguminous seeds iodin was found in 11 samples out of 32; more commonly among beans, peas, and cowpeas than among soy beans.

"The manufactured foods and milling and manufactory by-products contained iodin in 13 samples out of 25; of those containing iodin 10 were made from cereals. The offal parts of the grains are richer in iodin than are the more starchy parts.

"Agar agar and Irish moss (used in making blanc mange) were richer in iodin than any other products examined."

No iodin was found in 7 kinds of nuts examined and none in 16 samples of table salt.

"The more important sources of iodin in the human dietary . . . [aside from Irish moss] are the garden vegetables, though some is also found in the cereal foods, and in several foods of animal origin, mostly of the sorts less commonly used. Among the foods used by live stock the more important sources of iodin are the hay, silage, and forage crops, and also the milling and manufactory by-products, comparatively little being found in the natural grain foods."

While iodin was found to be more commonly present in foods from some regions than from others, no general geographical distribution of iodin in foods was discovered, and the iodin content of samples of the same food products from the same field often varied widely. "None of the ordinary methods of fertilization, or other details of management of the soil have been found, in any regular way, to affect the iodin content of field crops."

No relationship between the iodin content of foods and the prevalence of goiter was discovered.

An earlier report of this investigation has been noted (E. S. R., 35, p. 555).

The iodin content of foods, E. B. FORBES, F. M. BEEGLE, ET AL. (*Jour. Med. Research, 34 (1916), No. 3, pp. 445–458*).—The bulk of the material in this article is noted above.

Digestibility of very young veal, C. F. LANGWORTHY and A. D. HOLMES (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 16, pp. 577–588*).—This series of experiments was undertaken to determine the completeness of digestion of very young or "bob" veal by human subjects.

Preliminary tests were made in which the young veal was prepared by different methods and eaten by a number of individuals of varied ages and activities. In these cases no physiological disturbances resulted from the ingestion of the veal.

A series of digestion experiments was conducted with five normal young men in good health. The veal used in these experiments was obtained from calves not over five days' old and was eaten with a basal ration of fruit, bread and butter, and tea or coffee with sugar. The experimental periods were of three days or nine meals each. An average of 237 gm. of veal, which furnished 78 gm. of protein or approximately 75 per cent of the total protein in the diet, was eaten daily. The average value for seven experiments of the digestibility of the total protein in the diet was 92.9 per cent and of the protein of the veal 92.7 per cent. No physiological disturbances were experienced by the subjects, who reported that with the exception of one or two colds they were in normal physical condition throughout the investigation.

For comparison, a study was also made of the digestibility of market veal. Veal from animals at least four weeks old was purchased in the open market and fed with the same basal ration to the same subjects. In these experiments the digestibility of the protein of the total diet was found to be 92.9 per cent and the protein of the market veal alone was estimated at 92.8 per cent.

The results of these experiments indicate that the digestibility of the protein of bob veal is the same as that of market veal, or approximately 93 per cent.

The authors conclude that bob veal can be prepared for the table in palatable ways and is not unwholesome when eaten in quantity, since, during the digestion experiments, the average weight of protein furnished by the veal exceeded that generally furnished by meat in the ordinary diet. "The experiments here reported also indicate that the general opinion that young veal is a common cause of digestive disturbance or fails to digest as thoroughly as similar foods is not justified."

Digestibility of hard palates of cattle, C. F. LANGWORTHY and A. D. HOLMES (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 17, pp. 641–648*).—The hard palates, taken from the roof of the mouth of beef animals, consist chiefly of connective tissue (about 60 per cent) and erectile fibers (about 20 per cent) and contain very little muscular tissue, such as is characteristic of meats in general. Analysis showed the composition of the fresh material to consist of water, 71 per cent; protein ($N \times 6.25$), 22.2 per cent (or protein by difference, 16.6 per cent); fat, 11.8 per cent; and ash, 0.6 per cent.

The high protein content suggested the possibility of the use of hard palates as food and their digestibility was studied by feeding them for a three-day period, with a basal ration of potatoes, crackers, butter, and tea or coffee with sugar, to four healthy young men as subjects. The cooked and finely ground hard palates were made up into a meat loaf which furnished 82 per cent of the total protein consumed. The digestibility of the protein of the meat loaf alone, which closely approximated that for the protein of the hard palates, was found to be 86.8 per cent.

The authors conclude from the results of this investigation that "it would seem that the protein of hard palates which have been thoroughly cooked is somewhat less thoroughly assimilated than that of the common cuts of meat."

"In view of the fact that over 130 gm. of protein, largely supplied by the meat loaf, and over 3,200 calories of energy were consumed daily, it is apparent that the ration was eaten with relish."

Artificial purification of oysters.—A report of experiments upon the purification of polluted oysters by placing them in water to which calcium hypochlorite has been added, W. F. WELLS (*Pub. Health Rpts. [U. S.], 31*

(1916), No. 28, pp. 1848–1852).—An extended series of experiments carried out by the author indicates that "oysters which have lain in polluted water can be artificially purified to such a degree as to pass a most rigid standard by exposure for a short period in water containing calcium hypochlorite." The experiments appear also to demonstrate the feasibility of such a process.

The rapidity with which alcohol and some sugars may serve as nutrient, H. L. HIGGINS (*Amer. Jour. Physiol., 41 (1916), No. 2, pp. 258–265, fig. 1*).—To determine how soon after its ingestion alcohol is burned in the body, determinations were made of the respiratory quotient for periods of from three to five minutes in length during the 15-minute interval following the ingestion of 30 cc. of absolute alcohol, taken in admixture with cold cereal coffee. In a similar way was studied the effect of the ingestion of the more common sugars, glucose, levulose, sucrose, lactose, and maltose. The following conclusions are drawn from these experiments:

"Alcohol begins to be burned in appreciable quantity in from 5 to 11 minutes after taking; with some subjects the combustion began more quickly than with others. Sucrose, lactose, and levulose begin to be burned quite as soon as alcohol, if not sooner. Glucose and maltose are not utilized as food as soon as the other sugars or alcohol, approximately 20 to 30 minutes elapsing before their combustion plays an important part in the metabolism. There is a distinct difference between the metabolism in men of glucose and levulose and galactose, as shown by a study of the gaseous exchange, especially the respiratory quotients."

Vanilla extract, J. R. DEAN and J. O. SCHLOTTERBECK (*Jour. Indus. and Engin. Chem., 8 (1916), Nos. 7, pp. 607–614, figs. 2; 8, pp. 703–709*).—Among the factors studied as influencing the quality of vanilla extract were the composition of the beans; the relative values of grinding or chopping; methods of drying; the moisture content of the beans; the effects of varying amounts of alcohol in the extract; the use of alkali; the addition of sugar, sand, and glycerin; the effect of grade and length of beans; the solvent action of vanilla extract on certain metals; the aging of the extract; and methods of manufacture. The opinions of different manufacturers on some important questions relative to vanilla extract were obtained by submitting to them a list of questions, which are given together with a composite of the answers. The following conclusions are drawn:

"Vanilla beans are improved on aging where the aging is conducted under proper conditions. Vanilla beans should be chopped and not ground.

"Vanilla beans can be dried without material loss of flavor if the drying is carefully carried out at room temperature (60 to 70° F.). Extracts made from dried beans have higher color and lead number values than those made from the same but undried beans. Where the beans are not dried the menstruum should be regulated to suit the moisture present in the beans.

"The physical constants are not greatly affected by the various amounts of alcohol in the menstruum as long as the amount of alcohol is sufficient to produce a clear extract. The color values are slightly increased and the lead number values are slightly decreased by an increase of alcohol up to a maximum of about 65 per cent. The flavor of an extract prepared with 60 per cent alcohol is superior to that made with 50 per cent alcohol.

"The resins of vanilla beans are of no value as flavoring agents, but are of value as fixatives for the flavoring compounds present and as coloring matter for the extract.

"Alkaline menstrua produce extracts that are higher in color and lead number values, but the alkali impairs the natural flavor of the beans.

"Short maceration and percolation will not produce the maximum extract. The hot process produces an inferior extract, one that is lacking in delicate aroma. The most desirable extract is produced only by long maceration at room temperature as in the circulatory displacement method.

"Sugar does not increase the color of the extract and should be added to the percolate. Glycerin tends to increase the color and should be added to the menstruum before percolation or maceration.

"Vanilla extract should not be left in contact with any metal that is not completely covered with tin.

"Vanilla extract is decidedly improved by aging. The period of the aging should be at least one year and should be carried out at room temperature (60 to 70° F.) and in unpainted, porous, wooden barrels."

A bibliography is appended.

[Food and drug inspection], E. F. LADD and ALMA K. JOHNSON (*North Dakota Sta. Spec. Bul., 4 (1916), No. 6, pp. 132–163*).—In addition to giving data regarding a number of samples of foods and drugs inspected, this bulletin contains an article by Mae A. Englehorn on the Drug Plants of North Dakota, abstracted on page 730, and an article by R. E. Remington on the use of starch in canned corn.

Portion of acts and documents relative to public hygiene.—The work of the Superior Council of Public Hygiene of France (*Rec. Actes Off. et Doc. Hyg. Pub., Trav. Cons. Sup. Hyg. Pub. France, 42 (1912), pp. 889, figs. 5*).—This publication presents in detail the results of the inspection of foods, drugs, and beverages, and contains information regarding the handling and sale of food products, the hygiene of containers for different kinds of foods, and the preservation and adulteration of foods.

Comparative statistics on foodstuffs and fuel for three years (*Olympia, Wash.: State, 1916, pp. 3*).—The statistics given were based on prices prevailing in April of the years 1914–1916, inclusive, and were compiled by the state bureau of labor in connection with a study of the annual cost of living for a family of five persons.

Food for the family, A. GRACE JOHNSON (*Oreg. Agr. Col. Ext. Serv. Bul. 3 (1916), No. 10, pp. 13*).—A summary of information regarding the functions and choice of foods, meal planning, etc.

Kitchen organization and administration, C. S. PITCHER (*Columbus, Ohio: Bd. Admin., [1916], pp. 62 pls. 4*).—This paper, read at a meeting of the American Association of Officials of Charity and Correction, deals with the construction of kitchens, the equipment of kitchen and dining rooms, employees, and methods for the control of kitchen and table waste. The data given include standard basic dietary tables.

The problems of physiological and pathological chemistry of metabolism, O. VON FÜRTH, trans. by A. J. SMITH (*Philadelphia and London: J. B. Lippincott Co., 1916, pp. XV+667*).—This is an English translation of one volume of the original German edition. The material presented is based upon a series of 25 lectures, the purpose of which is to present the subject of normal and pathological metabolic chemistry as a broad and connected whole. In addition to an extended discussion of the digestion and metabolism of proteins, fats, and carbohydrates, chapters are devoted to the nutritional requirements of the body, energy and gaseous metabolism, tissue respiration, and fever.

The influence of the nature of the diet on the retention of protein, N. UMEDA (*Biochem. Jour., 10 (1916), No. 2, pp. 245–253*).—Experiments are reported in which a laboratory animal (dog) was given diets containing the same amount of protein and of the same fuel value, but varying greatly in their content of fat and carbohydrate. The following combinations were used:

Carbohydrate-rich, fat-poor diet; intermediate diet; and fat-rich, carbohydrate-poor diet. Each diet was preceded and followed by a period of several days, during which time a standard diet was given. The following conclusions are drawn:

"Nitrogen in the form of protein added to a carbohydrate diet is retained in greater amount than when added to a fat diet of equal caloric value. Nitrogen given in the form of caseinogen is more completely retained than when given in the form of gelatin. The addition of meat extract to gelatin does not increase the amount of nitrogen retained."

The protein metabolism of an infant, F. B. TALBOT and J. L. GAMBLE (*Amer. Jour. Diseases Children, 12 (1916), No. 4, pp. 333–344, figs. 1*).—This paper reports observations upon an infant receiving a diet in which the protein was increased in each successive period. It was found that the metabolism went on in a normal manner in spite of the increase of protein.

"The endogenous metabolism of uric acid, creatinin, and ethereal sulphates was maintained on a very constant level, while the exogenous metabolism, namely, urea, creatin, inorganic sulphates, and the metabolism of phosphates, chlorids, and undetermined nitrogen increased with the protein in the food. The fat and carbohydrate absorption was within normal limits, although the fat utilization . . . [in two periods] was almost outside normal limits. The retention of nitrogen suddenly dropped in the last period, even though there was a greater intake and absorption of nitrogen. This loss was found in the stools, in which casein curds were found in large numbers. The ammonia in the stools increased with the increasing protein intake, and may be considered an index of intestinal putrefaction."

Effect of autolysis upon muscle creatin, R. HOAGLAND and C. N. MCBRYDE (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 14, pp. 535–547*).—The data obtained in these experiments are reported as a contribution to the knowledge of the source and method of production of creatinin in the animal body.

In one series of experiments, under aseptic conditions, pieces of muscular tissue were cut from the hind quarter of a steer, sealed in sterile dishes, and allowed to undergo aseptic autolysis at 37° C. for periods ranging from 7 to 100 days, at the end of which the percentages of free and total creatinin were determined. Only such samples as were found on bacteriological examination to be sterile were used. In another series antiseptic methods were employed, chiefly as a check and for comparison with the aseptic method. Pieces of muscular tissue were finely ground with sand and placed in flasks with salt solution, chloroform and toluol being added to prevent bacterial growth. These were kept at 37° for periods ranging from 2 to 84 days and the percentages of total and free creatinin determined. In both series of experiments analyses were made of samples of the fresh muscular tissue for comparison.

The results of these experiments show that muscular tissue has the power, in a marked degree, to convert creatin into creatinin and has the ability, in an appreciable degree, both to produce and destroy creatinin. It was also found that during the course of autolysis an equilibrium is finally established between creatin and creatinin. This, in the opinion of the authors, denotes that "in autolyzing muscular tissue the rate of reaction is very greatly accelerated, but that the total extent of the change is the same in either case. The more rapid change of creatin into creatinin in the autolyzing tissue may safely be assumed to be due, in large part, at least, to enzym action. This conforms to our idea as to the catalytic nature of enzyms. The gradually reduced rate of change of creatin to creatinin during autolysis is in conformity with the law of mass action."

In the animal body the change of creatin to creatinin takes place at its maximum velocity, since the creatinin is rapidly removed. The fact that muscular tissue has the power to convert creatin into creatinin is important evidence in support of the theory that muscle creatin is the source of urinary creatinin with a creatin- and creatinin-free diet, and also that the transformation of creatin into creatinin takes place in part at least in the muscular tissue.

The influence of diet on the development and health of the teeth, J. I. DURAND (*Jour. Amer. Med. Assoc., 67 (1916), No. 8, pp. 564, 565*).—Studies of other investigators reviewed here indicate that the teeth of children fed during six months of the first year on sweetened condensed milk showed a higher percentage of caries (about 72 per cent) than those of children fed upon breast milk or modified cows' milk (about 42 per cent). The author states that "a poorly balanced diet, high in carbohydrate and low in fat, protein, and mineral constituents, fed during the period in which the teeth were developing and calcifying in the jaws, seems to have rendered them doubly susceptible to decay after they erupted."

Emphasis is also laid upon the advantage of tough and hard foods, which develop the muscles of mastication and enlarge and strengthen the jaws, and upon the cleaning effect of such foods as meat, fresh vegetables, acid fruits, and fibrous foods. Also, the ptyalin content and alkalinity of the saliva secreted vary with the flavor, acidity, or hardness of foods. Acid fruits, producing a highly alkaline saliva with a high ptyalin content, are recommended as valuable foods with which to finish a meal.

Dietary deficiency as the etiological factor in pellagra, E. B. VEDDER (*Arch. Int. Med., 18 (1916), No. 2, pp. 137–172*).—In this paper the author considers the analogies which exist between pellagra and the two deficiency diseases beri-beri and scurvy, and also the question of whether the evidence pointing toward infection can be explained on the deficiency hypothesis. An extended study is reported of the diets of a large number of pellagrins, in order to determine whether or not a deficiency could be demonstrated in these diets. The author considers also a number of changes which have occurred during the past 10 years in the South which may account for the increase in pellagra. The following conclusions are drawn from the investigation:

"There is a certain similarity between pellagra and other known deficiency diseases, namely, beri-beri and scurvy. Much of the evidence that has been presented as a proof of the infectious nature of pellagra can be reasonably explained in accordance with a deficiency hypothesis.

"A deficiency is demonstrable in the diets of most pellagrins. This deficiency appears to . . . [the author] to result from the too exclusive use of wheat flour, in association with corn meal, salt meats, and canned goods, foods that are known to be deficient in vitamins.

"Changes in the diet of the people of the South have occurred during the past 10 or 15 years. Since . . . [all the changes that have occurred are not known and the importance of the known changes can not be judged accurately], it is unscientific to assume that the recent increase in pellagra can not be due to such changes.

"The hypothesis that pellagra is caused by a deficiency is very plausible and must be taken into consideration in subsequent studies of this disease."

Some metabolic effects of bathing in the Great Salt Lake, II, HELEN I. and H. A. MATTILL (*Amer. Jour. Physiol. 41 (1916), No. 2, pp. 143–152*).—This investigation was made to determine whether the findings in an earlier study (E. S. R., 33, p. 367) were significant and constant.

"Two subjects were maintained on a uniform diet for twelve days. A bathing period of four days followed a fore period of five days, with a three-day

final period. The urine was analyzed in 24-hour periods on all of the days and in short periods (three to four hours) on three bathing and on three nonbathing days.

"In agreement with former results the progress of the bathing period was attended by increased nitrogen and salt excretion, which, in this case, however, persisted through the final period. The three-hour period during and immediately following the bath showed a considerable increase (15 to 50 per cent) in nitrogen and salt excretion as compared with the same period on days when no bath was taken, indicating that the bath had an immediate influence as well as a prolonged effect.

"A constant and uniform parallelism between nitrogen and chlorid variations, noted also in earlier work, is not understood. Decreased perspiration through the cooling of the skin by the bath can account in only small measure for the greater salt and nitrogen excretion in the urine following the bath."

The pathological and therapeutic bearings of the elimination of body heat, J. B. NICHOLS (*Med. Rec.* [*N. Y.*], *90* (*1916*), *No. 12, pp. 492–495*).—In this article a number of factors are considered which influence the rate of elimination of body heat.

A respiration calorimeter, partly automatic, for the study of metabolic activity of small magnitude, C. F. LANGWORTHY and R. D. MILNER (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 18, pp. 703–720, pls. 4*).—This article describes in detail the construction and operation of a small respiration calorimeter, which has been briefly noted in earlier publications (E. S. R., 27, p. 568; 29, p. 462).

The results are reported of electric and alcohol check experiments, which show that the heat and the products of respiration generated in the chamber may be determined with a high degree of accuracy in this respiration calorimeter.

ANIMAL PRODUCTION.

Rape as material for silage, A. R. LAMB and J. M. EVVARD (*U. S. Dept. Agr., Jour. Agr. Research, 6* (*1916*), *No. 14, pp. 527–533*).—Experimental silage was prepared at the Iowa Experiment Station from rape alone and from mixtures of rape with various other materials, such as alfalfa, red clover, sweet clover, potato tubers, timothy, Sudan grass, sorghum cane, and blue grass, with the purpose of determining the most satisfactory combination.

The rape used was quite mature but still succulent. The rape leaves were cut off at the main stalk, and the entire plant was cut 3 in. from the ground. The alfalfa was cut just before blooming. The corn, Sudan grass, and sorghum cane used were mature. The other plant materials were cut just before maturity. All the forage was cut by a silage cutter into half-inch lengths. The material was tightly packed into glass jars of about 1-gal. capacity. The jars were closed with metal caps, which were not too tight to prevent the escape of excess gases.

The jars were opened four months after filling and the condition, appearance, odor, and taste of the silage noted. With very few exceptions it was in a perfect state of preservation, of excellent texture and color, with a pleasant, somewhat aromatic odor, and generally of an agreeable taste, though quite sour. It was succulent without being too moist.

In order to ascertain its palatability to swine, a representative number of the various mixtures and some of the pure rape silage were fed to three lots of pigs. At first the animals, which were on a ration consisting mainly of corn and tankage, tasted the silage rather hesitatingly and seemed surprised by the

sourness, but kept at it until they had eaten it all, appearing to enjoy its succulency. On a second trial, three days later, the same animals ate it with great relish. Only one sample of those tried, a rape-molasses mixture, was refused by the animals.

It is thought that those mixtures containing fibrous material, such as sorghum cane, Sudan grass, timothy, and the corn plant, would be useful for cattle, but would not be as good feed for swine as pure rape silage, or the alfalfa, red clover, potato, or corn-grain mixtures. The mixtures of rape with legumes are deemed perhaps best from the standpoint of feeding as well as that of the quality of the silage. The rape improves the mixture, in that it supplies the necessary fermentable carbohydrates, which apparently are deficient in amount in the legume.

Chemical examination of the samples showed the acidity and alcohol content to be comparable in most cases to that of corn silage.

A contribution to the bacteriology of silage, J. M. SHERMAN (*Jour. Bact., 1 (1916), No. 4, pp. 445–452*).—The data presented in this paper suggest the probable importance of a group of acid-tolerant, acid-producing bacilli in the curing of corn silage. The organism concerned, while closely related to the *Bacillus bulgaricus* group of milk and the *B. acidophilus* group of the intestines, appears to differ somewhat from the typical members of these groups, notably by its comparatively abundant growth on ordinary laboratory media. The microscopic examination of silage juice demonstrates the presence of immense numbers of bacterial cells (always over one billion per cubic centimeter), most of which are bacilli which resemble morphologically the high acid-producing bacilli described. The aciduric bacilli of silage are constantly found in quite large numbers on corn fodder, so that silage made from corn is always amply seeded with these organisms.

Fish meal: Its use as a stock and poultry food, F. C. WEBER (*U. S. Dept. Agr. Bul. 378 (1916), pp. 21*).—The author notes the earlier use of fish meal as a feeding stuff in the United States and gives rather full abstracts of the more important literature pertaining to its use in this country and in other countries.

With proper attention to sanitary considerations in the processes, it is said that the undried fish residues may be made into fish meal for feeding purposes. The meal containing less than 10 per cent moisture will keep a very long time without decomposition.

During the season of 1914 a quantity of fish meal was made in the course of experiments upon the utilization as a stock food of the waste in the sardine industry on the coast of Maine. With the equipment used a yield of from 27 to 33 per cent of meal was obtained from the fish residue, and from raw material containing from 12 to 17 per cent of oil, over one-half the oil was removed by pressing. The oil obtained was bright, clear, and of a very high quality. After being stored in a barn at Eastport, Me., for two or three months and then shipped to Washington, D. C., for use in the feeding experiments reported in this bulletin, this fish meal was found to contain water 4.74 per cent, protein ($N \times 6.25$) 60.50, fat 14.56, crude fiber 0.61, ash 16.68, and salt ($NaCl$) 5.78.

In feeding tests by the Dairy Division of the Bureau of Animal Industry, dairy cows fed fish meal gave a greater yield of milk than those fed cotton-seed meal. The total milk fat from the two groups was about the same. There was some variation in the readiness with which the animals ate the ration containing fish meal. The meal had no detrimental effect on either the milk or butter.

Feeding experiments upon the value of fish meal for laying hens and for growing and fattening pigs were conducted by the Animal Husbandry Division of the Bureau of Animal Industry. In a comparison of fish meal with meat meal for laying hens, A. R. Lee reports that the lot fed the ration containing

fish meal laid an average of 113.1 eggs per hen in 32 weeks, and those fed a similar ration but containing beef scrap instead of fish meal averaged 128.4 eggs per hen. The hens ate the beef scrap a little more freely than they did the fish meal. No differences were noted in regard to size or flavor of eggs or the health and weight of the fowls.

In comparing fish meal with digester tankage (60 per cent protein) as supplements in a ration for pigs, F. G. Ashbrook reports that 12 grade Berkshire pigs averaging about 52 lbs. per head were divided into two lots and fed for 112 days, beginning January 19, 1915. The 8 pigs fed corn meal, middlings, and tankage (4:4:1) made an average daily gain per pig of 1.25 lbs. at a cost of 5.58 cts. per pound of gain, the average grain eaten daily per pig being 4.53 lbs. The 4 pigs fed corn meal, middlings, and fish meal (4:4:1) made an average daily gain per pig of 1.31 lbs. at a cost of 5.22 cts. per pound of gain, the average daily grain consumption per pig being 4.8 lbs.

At the close of the above period, May 11, 1915, the pigs were put on a ration for the fattening period, which lasted 28 days. The 4 pigs fed fish meal were continued on the same rations, and made an average daily gain per pig during the fattening period of 1.91 lbs. at a cost of 6.04 cts. per pound of gain and a daily grain consumption of 8.06 lbs. The 8 pigs previously fed tankage were divided into two lots of 4 pigs each. One of these lots was finished on a ration of corn meal and fish meal (9:1). They made an average daily gain per pig of 2.16 lbs. at a cost per pound of gain of 5.35 cts., their daily consumption of grain being 8.54 lbs. per pig. The other lot was fed corn meal and tankage (9:1). Their average daily gain was 2 lbs. per pig at a cost of 6.76 cts. per pound of gain, and they consumed 8.13 lbs. of grain daily per pig. In figuring the cost of gains in these tests, corn meal was valued at $27 per ton, wheat middlings at $30 per ton, digester tankage at $50 per ton, and fish meal at $35 per ton. It is stated that in these tests the hogs were extremely fond of the fish meal.

General directions for the manufacture of fish meal, opinions of stock-food manufacturers in reference to its use in the trade, and an estimate of the amount of raw material available for fish meal are given.

Cause and prevention of rancidity in palm nut kernel cake, R. B. Calder (*Jour. Agr. Sci.* [*England*], *7* (*1916*), *No. 4, pp. 470–472*).—The author concludes from his studies that palm nut kernel cake, if kept dry and cool, remains sweet for at least ten weeks. If moist and warm it becomes rancid in a few days. The cake contains a zymogen which under the influence of warmth and moisture forms a lipase, which then turns the oil rancid. The lipase can be destroyed by heating the moistened cake to 70° C. (158° F.) for a short time. If the dry cake is heated the zymogen is usually destroyed, but dry heating is not so certain to destroy it as heating when moist.

Studies on the acidity of various feeding stuffs, L. Wilk (*Ztschr. Landw. Versuchsw. Österr., 18* (*1915*), *No. 8–9, pp. 485–558*).—Data on the acidity of the following feeding stuffs are given: Pumpkin-seed cake and bran, sunflower seed cake, rape seed cake, linseed cake, peanut cake, molasses feed, sesame cake, rice meal, coconut cake, cotton-seed meal, palm-kernel cake, corn germs, dried beet foliage, potato pulp, and blood, meat, and fish meal. Methods of determining acidity are discussed.

Tricolor inheritance.—I, The tricolor series in guinea pigs, H. L. Ibsen (*Genetics, 1* (*1916*), *No. 3, pp. 287–309, figs. 4*).—In this paper, reporting work at the Wisconsin Experiment Station, the factors more or less directly concerned with tricolor inheritance in guinea pigs are described and their interrelations shown.

In the experimental results it is shown "that tricolors may be of two kinds, those homozygous and those heterozygous for the e^p or black-spotting factor; that black-and-whites of tricolor parentage are also either homozygous or heterozygous for the same factor; and that red-and-whites of tricolor parentage may carry the e^p factor in a homozygous or heterozygous condition, or it may be altogether absent, in which event the red-and-white breeds true.

"Red-and-whites may be tested for the presence of the black-spotting factor by mating them to homozygous self reds. If the factor is present there will be tortoises among the offspring; if it is absent they will be all self reds.

"Black-and-whites of the tricolor series, homozygous for e^p, produce only tortoises when mated to homozygous self reds; if they are e^pe half of the offspring are tortoises and the other half self reds. Both these kinds of black-and-whites, therefore, produce some tortoises, but no self blacks when mated to self reds.

"Black-and-whites carrying E may be of three kinds, EE, Ee^p, and Ee. The first kind when mated to homozygous self reds produce all self blacks; the second kind, half self blacks and half tortoises; the third kind, half self blacks and half self reds. Black-and-whites carrying E, therefore, always produce some self blacks when mated to self reds, but in some instances (when Ee^p) also produce tortoises.

"EE and Ee black-and-whites were produced by mating self blacks to ee red-and-whites and inbreeding the F_1 self blacks. Some of the F_2 generation are black-and-whites which are either EE or Ee. The first kind when mated together breed true.

"Animals of the tricolor series carrying a large amount of black pigmentation (e^p) and also a large amount of white spotting tend to produce a comparatively large number of black-and-whites and no e^p red-and-whites. Those carrying a small amount of black pigmentation tend to produce a comparatively large number of e^p red-and-whites and no black-and-whites.

"The statement is made, but complete experimental proof is reserved for a later paper, that the three factors, E, complete extension of black pigment, e^p, partial extension, and e, nonextension, form an allelomorphic series."

A bibliography of literature cited is given.

Inbreeding in tail-female, W. H. E. Wanklyn (*Bloodstock Breeders' Rev., 5 (1916), No. 2, pp. 140–142*).—The author states that inbreeding to the male line has hundreds of prominent successes so far as to the female in her influence on future generations is concerned, while the results of inbreeding in female-tail can be counted in small numbers. Examples of successes in female-tail inbreeding are given.

Sex control and known correlations in pigeons, O. Riddle (*Amer. Nat., 50 (1916), No. 595, pp. 385–410, fig. 1*).—The author states that the studies that have thus far been made on sex and on the experimental control of sex in pigeons go very far toward an adequate demonstration that germs prospectively of one sex have been forced to produce an adult of the opposite sex—that germs normally female-producing have, under experiment, been made to develop into males, and that germs which were prospectively male-producing have been made to form female adults. Neither selective fertilization, differential maturation, nor a selective elimination of ova in the ovary can account for the observed results. Further, and perhaps of more importance, these studies throw much new light on the nature of the difference between the germs of the two sexes. This difference seems to rest on modifiable metabolic levels of the germs; males arise from germs at the higher levels, females from the lower; and such basic sex differences are quantitative rather than qualitative in kind.

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The animal-breeding industry, R. Pearl (*Sci. Mo., 3 (1916), No. 1, pp. 23–30*).—A general article treating of the number and value of farm live stock in the United States, exports and imports.

Sheep management; breeds and judging, F. Kleinheinz (*Madison, Wis.: Author, 1916, 3. ed., rev. and enl., pp. XX+306, figs. 111*).—This is the third edition of this book, revised and enlarged (E. S. R., 26, p. 570).

The improvement of the sheep of the Middle Tiber Valley by means of crossing with Rambouillet Merinos, P. Pazzini (*Staz. Sper. Agr. Ital., 48 (1915), No. 9, pp. 649–676; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 6 (1915), No. 12, pp. 1681–1683*).—In these experiments it was found that compared with the native breed the crosses show better shape, greater weight of the lambs at birth, greater increase in weight of the lambs, greater carcass weight in the wethers, and greater chest index, together with a lower heart and lung index. Observations made on the production of wool show that the crossbreds have an additional advantage, both as to absolute weight of fleece and quality of fiber.

A new fleece record claimed, W. Stemmons (*Breeder's Gaz., 69 (1916), No. 21, p. 1114*).—It is claimed that the heaviest fleece ever shorn from a single sheep was recently taken from a 2-year-old Rambouillet ram on the farm of the Oklahoma Agricultural College. The fleece weighed 46.25 lbs. The fibers of the fleece were measured and found to average 1/1800 of an inch. The average length of the staple of this fleece was 3.25 in., and the average length of the fiber when stretched 5.25 in. This fact shows that the crimp is exceptionally good, and because of this the felting properties of the wool are extraordinary.

Mendelism of short ears in sheep, E. G. Ritzman (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 20, pp. 797, 798*).—The author describes a distinct type of short ears in sheep which in breeding experiments at the New Hampshire Experiment Station has behaved as a simple Mendelian unit factor, being dominant over long ears.

Corn silage for lambs, J. W. Wilson (*South Dakota Sta. Bul. 165 (1916), pp. 377–390, figs. 7*).—This bulletin gives results of two experiments involving 140 lambs, those for the 1914 test being home-grown or native lambs and those used in 1915 being western range lambs. Each fall there were 7 lots of 10 lambs each. The rations fed, the grain part of which was a mixture of corn and oats half and half by weight, and some of the results obtained are given in the following table:

Results of lamb-feeding experiments in 1914 and 1915.

Lots.	Average daily ration per head.	1914		1915	
		Daily gain per head.	Feed cost per pound of gain.	Daily gain per head.	Feed cost per pound of gain.
		Pounds.	*Cents.*	*Pounds.*	*Cents.*
1	1.15 pounds grain, 1.38 pounds silage	0.13	11.44	0.08	12.00
2	1.52 pounds grain, 0.72 pound silage, 0.76 pound hay	.23	8.45	.18	9.69
3	1.52 pounds grain, 0.6 pound silage, 0.86 pound hay	.28	7.12	.23	7.83
4	1.49 pounds grain, 0.49 pound silage, 0.97 pound hay	.28	7.09	.21	8.39
5	1.51 pounds grain, 0.37 pound silage, 1.23 pound hay	.25	7.96	.19	9.23
6	1.52 pounds grain, 0.22 pound silage, 1.33 pounds hay	.24	7.21	.17	10.40
7	1.51 pounds grain, 1.11 pounds hay	.23	7.45	.16	10.47

In figuring the cost of gain, grain was valued at $20 per ton, silage at $3 per ton, and prairie hay at $6 per ton.

Tables are given showing individual weights and gains of lambs, as well as results of feeding experiments with lambs previously noted (E. S. R., 23, p. 176).

Self-feeding hogs, A. F. Sayre (*Country Gent., 81 (1916), No. 27, p. 1296*).—In a feeding operation on a Wisconsin farm 59 spring and fall Duroc shotes were fed shelled corn by the self-feeder method for 35 days and made an average daily gain per head of 2.45 lbs., consuming 5.1 lbs. corn per pound of gain, and realizing a profit of $61.65 on the lot. This amounted to a net feeding profit per bushel of corn of 14 cts., the cost of the corn being 68 cts. per bushel.

Feeding experiments with work horses, N. Hansson (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 126 (1915), pp. 54, figs. 3; abs. in K. Landtbr. Akad. Handl. och Tidskr., 55 (1916), No. 3, pp. 218–229; Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 275–277*).—From these experiments it is concluded that 1 lb. of barley may be replaced by the following quantities of other foods for work horses: One and one-tenth lbs. mixed barley and oats, 1.2 lbs. oats, from 0.95 to 1 lb. corn, 1 lb. molasses, 1.1 lbs. sugar-beet slices, 1.2 lbs. wheat bran, 1.5 lbs. mixed oat bran and rice meal (3:2), 1.8 lbs. oat bran, 0.9 lb. dry matter in potatoes, and 1.1 lbs. dry matter in roots. Where considerable quantities of potatoes, roots, molasses, corn, etc., are fed additional protein must be given in the form of peanut cake, soy-bean cake, linseed cake, peas, beans, gluten feed, or good hay with clover, alfalfa, or other leguminous fodder.

The following are given as the requirements of work horses of 1,300 lbs. live weight, as regards digestible protein (pounds per head per day): Easy work, from 1.1 to 1.32 lbs.; moderate work, from 1.32 to 1.76; hard work, from 1.76 to 2.2; very hard work, 2.2 lbs. or more.

Sour milk for chicken feeding, H. L. Kempster (*Missouri Sta. Circ. 79 (1916), pp. 4, fig. 1*).—Three 25-bird pens of White Leghorn pullets were fed from November 1, 1914, to October 31, 1915, to test the effect of sour milk on egg production. About two-thirds of the ration of each of the pens consisted of a scratch feed of corn and wheat (2:1). One lot which received no meat was fed a mash of bran, middlings or shorts, and corn meal; another lot was fed the same mash and in addition all the sour milk the fowls wanted; a third lot was fed the same mash with beef scrap.

The no-meat pen laid an average of 65 eggs per hen for the year, the beef-fed hens an average of 107 eggs each, and the sour-milk-fed hens an average of 131 eggs each. On a cost basis per hundredweight for feeds of $1.66 for wheat, $1.60 for corn, $1.20 for bran, $1.70 for corn meal, $1.40 for shorts, $3.25 for beef scrap, and 20 cts. for sour milk, and, with eggs at 20 cts. per dozen, there was a loss of $1 on the lot fed no meat, a profit of $19.78 on the lot fed beef scrap, and a profit of $28.26 on the lot fed sour milk.

Artificial brooding and chick feeding, W. F. Schoppe (*Montana Sta. Circ. 56 (1916), pp. 193–207, figs. 8*).—A description and working plans are given of a colony brooder house in which are installed two of the Maine fresh-air brooders (E. S. R., 26, p. 572). Directions for operating the brooder and feeding the chicks are included.

Fecundity of hens in relation to size of egg, E. Brown (*Jour. Bd. Agr. [London], 23 (1916), No. 3, pp. 230–233*).—Data taken from a laying competition, including 162 White Wyandotte pullets and 156 White Leghorn pullets, are given. The number of eggs laid by each pullet were divided into first grade (2 oz. and upwards), second grade (1.75 oz. to 2 oz.), and third grade (under 1.75 oz.).

In the case of the White Wyandottes the pen from which the highest number of eggs was obtained stood lowest but two in the percentage of first-grade eggs, the poorest of all in that respect standing third on the list as to number of eggs laid, while that which was lowest as regards the number of eggs was nearly the lowest also in point of first-grade eggs. On the other hand, the pen second in total number of eggs was also second in respect to size of egg. At the same time, with some exceptions, the figures in respect to size of egg favor the pullets, which were medium in fecundity. The mean of the breed in both directions to secure good marketable size, though the average is a low one, is from 800 to 900 eggs per six birds per annum.

With the Leghorns there was nothing to indicate that high fecundity is responsible for any diminution of the size of egg. The pen of Leghorns that was third in that breed was first in first-grade eggs (96.25 per cent), while the pen which was second in respect to first-grade eggs (95.56 per cent) was last save one in the total number of eggs laid.

It is stated that Leghorns are naturally more prolific than Wyandottes, and it may be expected, therefore, that forcing production will have a greater physical influence upon the latter, especially as the eggs are smaller than those of the former.

The ostrich-feather industry in South Africa, R. W. Thornton (*So. African Jour. Sci., 12 (1916), No. 7, pp. 272–279*).—This article treats of the varieties of ostriches in Africa, their distribution, domestication, incubation, feeding, care, and management, clipping and quilling, and the marketing of feathers.

The breeding of "whitefish" (Coregonus spp.) in Switzerland, G. Surbeck (*Schweiz. Fisch. Ztg., 23 (1915), No. 11, pp. 296–305; abs. in Internat. Inst. Agr. [Rome], Mo. Bul. Agr. Intel. and Plant Diseases, 7 (1916), No. 1, pp. 112–114*).—Artificial hatching and stocking of the lake herring or whitefish has met with success in Switzerland and is being encouraged. It is estimated that the weight of whitefish annually caught in the Swiss lakes is about 2,640,000 lbs. This represents a value of from \$400,000 to \$500,000, while the total gross returns from all species of fish from Swiss waters is estimated at somewhat over \$1,500,000.

DAIRY FARMING—DAIRYING.

The influence of the plane of nutrition of the cow upon the composition and properties of milk and butter fat: Influence of overfeeding, C. H. Eckles and L. S. Palmer (*Missouri Sta. Research Bul. 24 (1916), pp. 3–39, figs. 4*).—The investigations reported in this bulletin included four experimental periods and dealt with the influence of a supernormal plane of nutrition of cows upon the composition and properties of milk and milk fat. The cows used were a pure-bred milking Shorthorn in her fourth lactation period, a pure-bred Ayrshire in her fourth lactation period, and a pure-bred Jersey in her second and again in her third lactation periods. In the experiments the plane of nutrition varied from normal to plus 104 per cent. The grain and hay part of the rations, which was of the same character in all experiments, consisted of choice alfalfa hay and a mixture of corn chop, wheat bran, and linseed meal (4:2:1). The proportion of grain to hay varied in the different tests. In some cases the hay was supplemented by corn silage or by green alfalfa.

The experiments covered cases where a normal plane of nutrition prevailed previous to overfeeding and where the overfeeding was preceded by a subnormal plane of nutrition. It was found in both these cases that the most pronounced

result of overfeeding was to cause the cow to gain in weight, and that in none of the experiments did overfeeding exert an influence toward abnormality in composition of the milk or milk fat. In one case a high supernormal plane of nutrition prevented further changes in the constants of the milk fat due to declining lactation. In two cases where the composition of milk and the constants of the fat were abnormal, due to previous underfeeding, the result of overfeeding was to restore normality. The conclusion is reached "that normal milk and butter is to be expected when the cow is on a supernormal plane of nutrition as well as when the plane of nutrition is normal, provided there are no other influencing factors such as specific feeds."

Data obtained on the effect of overfeeding on milk flow indicate that the secretion of milk is regulated by at least two factors, designated as chemical and nervous. Facts brought out in the investigations are thought to show that the chemical stimulus, which is the stimulus that fixes the maximum milk flow and which is more or less independent of the plane of nutrition, is the predominating stimulus immediately following and for a period after parturition, but that as the lactation period advances the chemical stimulus gives way for the nervous stimulus. The nervous stimulus is dependent upon the plane of nutrition of the cow.

In one case only was there a marked increase in milk flow due to a superplane of nutrition. In this case the milk flow of the cow had been appreciably reduced by underfeeding. The results indicate, however, that a very high plane of nutrition is effective in holding off the decline in milk flow due to advanced lactation.

In two of the four experiments the percentage of fat was slightly affected by overfeeding. In one case there was a reduction of 0.2 per cent, but this accompanied an increased milk flow, the total fat production remaining practically constant. In the other case a high fat content due to previous underfeeding was restored to normal. With three of the cows the protein content of the milk, which in each case had been appreciably depressed, was restored to normality by overfeeding. In the other case intense overfeeding caused a constant high protein level of from 0.4 to 0.5 per cent throughout the entire period. This fell back to normal when the plane of nutrition was reduced. This increased protein percentage was accompanied by an increased milk flow.

The lactose percentage was the least uniformly affected by supernormal feeding. In the case of the Jersey cow, which started her lactation period in a very low state of nutrition and with an abnormally low lactose percentage in the milk, the lactose content was gradually raised to its normal value. The only effect of overfeeding on the saponification value of the milk fat was a strong tendency to produce a normal value. This was also true of the Reichert-Meissl number, the oleic acid content, and the melting point of the milk fat.

The influence of the state of nutrition on the composition of milk fat immediately following parturition is discussed.

Data connected with the experiments are tabulated in detail and shown graphically in the appendix.

The changes in composition of butter fat produced by feeding cotton-seed oil, F. H. Smith, C. A. Wells, and P. V. Ewing (*Georgia Sta. Bul. 122 (1916), pp. 95–111*).—This is a detailed report of investigations previously noted (E. S. R., 35, p. 71) on the changes in composition which milk fat undergoes when the animal receives a ration containing cotton-seed oil, and on the transfer of food fat to the milk fat.

Two lots of two pure-bred Jersey cows each were fed a basal ration of silage, corn meal, and alfalfa hay from December 20, 1915, to January 16, 1916, when lot 1 was also given 0.5 lb. cotton-seed oil per head daily for two weeks, then increased to 1 lb. daily for two weeks, after which no cotton-seed oil was fed. Lot 2 received the basal ration throughout. Samples of butter from the mixed milk of each lot, morning and evening milking, were collected at the end of the second week of each period and at weekly intervals from the second week until the end of the test.

The milk fat from the two lots on the basal ration was almost identical in composition, but during the oil feeding period the saponification number for the fat of lot 1 decreased from 229.24 to 224.65, while with lot 2 there was little change. The soluble fatty acids decreased with oil feeding and the insoluble acids rose from 88.41 per cent to 89.3 per cent. The mean molecular weight of the insoluble acids increased from 259.06 to 264.75 during the oil feeding period. The mean molecular weight of the insoluble fatty acids of the cotton-seed oil was 292.8. The iodin number increased from 29.56 to 34.32 during the oil feeding period. The unsaponifiable matter in the butter remained practically constant throughout the experiment, and the variations in acid number, Reichert-Meissl number, and acetyl value were insignificant. With the Halphen test the fat of lot 1 showed a coloration corresponding to 0.5 or 0.6 per cent cotton-seed oil content during the period when 0.5 lb. oil was fed daily and 1 per cent oil content during the period when 1 lb. of oil was fed. The specific gravity of the milk fat was somewhat lowered and the melting point slightly raised while on the oil ration.

From these data the authors conclude that some change other than a simple transfer of cotton-seed oil to the milk fat had occurred. It was found that the addition of oil to the ration had the same general effect on the constants of the milk fat as an advance, in this instance, of five weeks in the lactation period.

"Cotton-seed oil, when fed in small quantities, was not transferred in any considerable amounts directly to the milk fat. Some of the substances of which the oil is composed apparently were transferred in a greater amount than others. The constituents of the oil did not reach the milk fat in those same combinations or proportions in which they exist in cotton-seed oil."

The more important literature pertaining to the subject is reviewed.

Important factors affecting machine milking, C. Larsen (*South Dakota Sta. Bul. 166 (1916), pp. 394–421, figs. 9*).—As a result of tests ranging from 7 months to 5 years and 3 months with seven makes of machines, the author points out factors other than the merits and demerits of different kinds of machines which have been found important in making machine milking a success. A comparison of the different makes of milking machines was not involved in these experiments.

In an experiment upon the germ content of machine-drawn milk the pail, rubber tubes, and all cups of a milking machine were thoroughly cleaned and scalded. The tubing and cups were kept in a disinfectant solution between milkings. The milk pail after being cleaned, rinsed, and steamed was kept in the milk room in an inverted position on a shelf between milkings. The average number of germs per cubic centimeter in the milk from the first cow with the machine was 5,325, from the second cow 3,017, and from the third cow 3,012. It is stated that thoroughly steaming the milk pails just before milking has been the means of greatly reducing the germ content of milk.

Results of experiments with disinfectants for the parts of milking machines showed that several substances are satisfactory, nothing being better for cheapness and simplicity than ordinary lime.

Studies on the numbers of bacteria present in milk which has undergone various changes, B. W. HAMMER and R. H. HIX (*Iowa Sta. Research Bul. 29* (*1916*), *pp. 35–62*).—In the work reported an effort was made to secure information regarding the numbers of bacteria required to produce various changes in milk. While changes in the flavor and odor first attracted attention, other changes were considered because of the difficulties presented by all work dealing with changes in flavor and odor. Sterile milk was used for most of the work, although some experiments were carried out with aseptic milk.

The authors conclude that "from the data presented it appears that changes in milk due to the growth of bacteria therein occur only after large numbers of bacteria are present. The samples of milk which showed changes of one kind or another always contained over 1,000,000 bacteria per cubic centimeter and ordinarily much larger numbers. The sweet curdlers produced changes in milk with the smallest numbers of organisms, and here the smallest number observed with slight coagulation was 1,250,000 per cubic centimeter. With some organisms pronounced changes required approximately 1,000,000,000 per cubic centimeter, and between this value and the minimum already mentioned wide variations were encountered.

"Wide variations apparently exist in the numbers of organisms present in milk showing the same condition. This is evident from the percentage variation between the minimum and maximum and also by the results obtained when freshly inoculated cultures were plated at two-hour intervals for considerable periods. The difficulty of classifying the conditions observed in milk are, in part, responsible for the variations obtained.

"When *Bacterium lactis acidi* was inoculated into aseptic milk a distinct rise in acidity was commonly detectable by the sense of taste before the milk could be classed as sour. There seemed to be no definite relationship between the rise in acidity and the classification of the milk as sour or as showing a distinct rise in acidity. Acidity increases of 0.03, 0.04, or 0.05 per cent (in one case 0.02) were detected by the sense of taste, and this means that quite low acidities (acidities that would be regarded as normal) may be encountered along with acid flavors in the milk."

Some effects of temperature upon the growth and activity of bacteria in milk, H. S. REED and R. R. REYNOLDS (*Virginia Sta. Tech. Bul. 10* (*1916*), *pp. 3–26*).—In this investigation upon the vitality of different species of bacteria in milk at different temperatures the factors studied were (1) the numbers of bacteria, (2) the proportion of acid-forming bacteria to others, (3) the changes affecting the consistency of the milk, (4) the quantity of acid formed in the milk, and (5) the reducing action as measured by the conversion of methylene blue. In securing pure cultures fresh milk was obtained from the college dairy, the cream separated, and samples of 100 cc. placed in Erlenmeyer flasks. The samples were sterilized fractionally by heating to 95° C. for 15 minutes on each of three consecutive days; they were then incubated for three days at 32°, and those which showed no signs of bacterial growth were given another fractional sterilization extending over three days. The samples were inoculated with a pure culture of the desired organism after the final sterilization and incubated at four different temperatures for a six weeks' period. During this time the multiplication of the organisms and their activity were studied at temperatures ranging from that employed in commercial milk storage to that of a warm summer day.

Results in detail are tabulated for each of the 13 organisms studied, a summary of which, showing the effect of age and temperature on bacterial growth, is given in the following table:

Effect of age and temperature on bacterial growth in milk.

Kind of organism.	Age, in days, of milk kept at various temperatures, which gave maximum counts on nutrient agar.			
	Incubator, 35° C.	Room, 15–28° C.	Water tank, 13° C.	Cold storage, −1° C.
Bacterium lactis acidi	1	3	5	3
Sarcina lutea	1	42	42	21
Bacillus coli	3	5	5	2
B. cyanogenes	2	21	4	42
B. proteus vulgaris	2	2	4	3
B. ærogenes	3	5	42	3
B. fluorescens liquefaciens	2	5	42	3
B. putidum	3	4	5	21
Microspira tyrogena	3	21	42	42
B. subtilis	3	42	21	21
M. citricus	21	5	4	4
Oidium lactis	42	42	5	42
B. prodigiosis	3	42	42	42

All the organisms studied grew to some extent at the temperature of −1°. Two types of micro-organisms were found very sensitive to this temperature. *B. lactis acidi*, representing one type, increased from 30 per cubic centimeter at the beginning to 2,870 per cubic centimeter on the third day, after which the members gradually decreased to 50 per cubic centimeter on the forty-second day. The other class, represented by *M. tyrogena*, grew very slowly at first but increased during the latter part of the observation period, reaching nearly 10,000 per cubic centimeter on the forty-second day. It is stated that this growth relationship has an important bearing upon the storage of milk at low temperatures for long periods. The milk might be appreciably changed in chemical composition yet remain sweet. Certain organisms commonly associated with filth, e. g., *B. fluorescens liquefaciens*, were more successful in growing at lower temperatures than the lactic acid bacteria.

"The temperatures of previous incubation appeared to have an influence upon the members of organisms developing upon gelatin and agar plates, as well as the optimum temperature for the different organisms. The members of organisms developing on agar plates were more or less closely correlated with the amount of acid formed and the curdling of the milk. The number of organisms developing on gelatin plates were more or less closely correlated with the formation of enzyms capable of reducing methylene blue."

Studies on the clarification of milk, B. W. Hammer (*Iowa Sta. Research Bul. 28 (1916), pp. 19–32*).—The results obtained in these studies show that plates poured from clarified milk commonly, although by no means constantly, revealed larger numbers of colonies of bacteria than plates poured from unclarified milk. Since clarifier slime contains large numbers of bacteria and contamination was practically excluded the increases in the number of colonies developing on plates were only apparent increases, due to the breaking up of clumps of organisms by the centrifuging. There was no definite relationship between the effect of clarification, on the one hand, and such factors as the original count, temperature of the milk, or the percentage of fat, on the other. It is concluded that whether there will be an increase or a decrease in the apparent number during clarification probably depends on the types of organisms and on the presence of clumps.

Fifty-one comparisons of the bacterial content of clarified and unclarified milk were made on samples showing less than 100,000 organisms per cubic centimeter. In 3 cases the bacterial content was not influenced by clarification,

in 14 cases it was decreased from 2 to 24 per cent (an average of 12 per cent), and in 34 cases it was increased from 2 to 256 per cent (an average of 41 per cent). For the entire 51 samples there was an average increase of 24 per cent. In 27 comparisons made on samples showing from 100,000 to 500,000 organisms per cubic centimeter, in 9 cases clarification caused a decrease of from 2 to 36 per cent (an average of 12 per cent), and in 18 cases an increase of from 3 to 187 per cent (an average of 43 per cent). In 14 comparisons made on samples showing over 500,000 per cubic centimeter, in 3 cases the bacterial content was decreased by clarification from 5 to 40 per cent (an average of 24 per cent), and in 11 cases increased from 4 to 102 per cent (an average of 29 per cent).

In 52 comparisons of the cell content, clarification caused a decrease of from 7 to 73 per cent (an average of 39 per cent). The average cell content of the unclarified milk was 297,481, and of the clarified milk 177,442 per cubic centimeter. The percentage of cells thrown out showed no relationship to the original cell content, the percentage of fat, or the temperature of the milk.

Large numbers of bacteria were found in all the samples of slime studied. In 11 tests on clarifier slime, using a 1-cc. sample, the counts ran from 31,000,000 to 1,445,000,000 per cubic centimeter, while on 36 samples of 1 gm. each the counts ran from 103,500,000 to 20,000,000,000 per gram. The cell content of clarifier slime also was constantly high. In 3 tests, using a 1-cc. sample, there were from 830,000,000 to 1,120,000,000 per cubic centimeter, while in 36 samples of 1 gm. each there were from 565,000,000 to 1,295,000,000 per gram. Neither the bacteria nor the cells were constantly present in greater numbers in any part of the slime.

Clarified pasteurized milk gave larger numbers of colonies on agar plates than unclarified pasteurized milk in 14 cases out of the 21 tried, while in the remaining 7 cases the unclarified pasteurized milk gave the higher counts. The larger numbers of colonies from the clarified samples were ascribed to the breaking up of the clumps as a result of the clarification.

The clarifier slime showed a certain amount of dirt, even when the milk clarified was produced under conditions that must be regarded as much above the average, and masses of red blood cells were occasionally found even when the milk was produced under careful conditions.

The ratio between the pounds of milk clarified and the amount of slime was very variable. This is explained, to a certain extent, by the fact that the milk came from various sources and presumably was produced under very different conditions.

"Since in the majority of cases clarification (either with or without pasteurization) causes an increase in the apparent numbers of bacteria in milk, it is necessary that in the bacteriological control of milk supplies this fact be taken into consideration. The increase may be a large one but, since it is only an apparent and not a true increase, high counts on clarified milk should not be considered as serious as approximately the same counts on unclarified milk. Serious contamination from a clarifier is not an impossibility and must be considered in dealing with clarified milk, but high counts on clarified milk evidently have a different significance than approximately the same counts on unclarified milk, due to the breaking up of the clumps during centrifuging."

VETERINARY MEDICINE.

Larkspur poisoning of live stock, C. D. MARSH, A. B. CLAWSON, and H. MARSH (*U. S. Dept. Agr. Bul. 365 (1916), pp. 91, pls. 15, figs. 12*).—This monographic work is divided into three parts. The first part (pp. 1–28) gives a historical summary and review of the literature, and discusses the alkaloids

of Delphiniums, the losses from larkspur poisoning, common names of larkspurs, species concerned in poisoning, and the detection of species in the stomach contents. Part 2 (pp. 28–59) presents the details of experimental work, and part 3 (pp. 59–84) is devoted to a discussion of the results obtained and the conclusions drawn.

The authors find that "it is rarely possible to recognize macroscopically larkspur material in the stomach contents of cattle. By means of microscopic sections of stems, however, not only can Delphinium be distinguished from other plants but groups of the genus can be distinguished from each other. The genus falls into six different types of stem structure.

"Experimental feeding of larkspur was carried on for three seasons at Mount Carbon, in Gunnison County, Colo. In this work four species of Delphinium were used which have been identified as *Delphinium barbeyi*, *D. menziesii*, *D. andersonii*, and *D. robustum*. A large number of animals was used in this work, including horses, cattle, and sheep. Similar feeding experiments were conducted during one season at Greycliff, Mont., on *D. cucullatum* and *D. bicolor*. These experiments showed that the larkspurs are poisonous to cattle and horses but not to sheep. Horses, however, in pastures or upon the range do not eat enough of the plants to produce any ill effects, so that losses of stock from larkspur poisoning are confined to cattle.

"The low larkspurs are poisonous during the whole life of the plants, but inasmuch as they disappear early in July, cases of poisoning are confined to the months of May and June. The tall larkspurs live through the summer season, appearing in early spring. They are most poisonous in their early stages. After blossoming the toxicity gradually diminishes and disappears and the plant dries up, although the seeds are very toxic. Most of the cases of poisoning in Colorado occur in May and June, with sporadic cases in July. In other localities where the larkspurs blossom later poisoning may occur as late as August or even September.

"While definite feeding experiments have been performed upon only a few species of larkspur, it may be assumed, from the knowledge of plant poisoning upon the ranges, that other species have the same properties as those experimented upon and that feeding upon them produces the same results. The experimental work and the autopsies showed a clearly defined line of symptoms and certain definite pathological results. The feeding showed that there was no marked difference in toxicity between the different species of larkspurs and that the quantity necessary to produce effects varied within rather wide limits, but that, generally speaking, a quantity equal to at least 3 per cent of the weight of the animal was necessary to produce poisoning.

"From somewhat extensive experimental work on antidotes it was found that beneficial results could be obtained by using, hypodermically, injections of physostigmin salicylate, pilocarpin hydrochlorid, and strychnin sulphate, followed by hypodermic injections of whisky when needed.

"Poisoning upon the range may be prevented in some cases by digging up the tall larkspur when the greater number of plants is confined to comparatively limited areas. In other cases the handling of the cattle in such a way that they will not have an opportunity to feed upon the larkspur may prevent losses. In the case of *D. menziesii* it is desirable that the cattle should be kept away from the ranges where this plant grows in abundance until about the first of July, when the plant dies. *D. barbeyi* loses its toxicity after blossoming, so that a range with this plant is safe for cattle in the late summer and fall. It should be remembered, however, that local and climatic conditions may delay the time of blossoming, so that no arbitrary date can be given when a range is safe. *D. bicolor* probably never grows in sufficient quantities to be dangerous

as a poisonous plant. Inasmuch as the experimental work seems to show quite conclusively that sheep may feed upon larkspurs with entire impunity it is desirable in some cases, where there is an especial abundance of larkspur, to use the ranges for sheep rather than for cattle or to combine sheep grazing and cattle grazing in such a manner as to keep the areas of low larkspur eaten down by the sheep."

A list of the more important literature relating to the subject and cited by the authors is appended.

Poisonous plants and stock poisoning on the ranges of Montana, D. B. SWINGLE and H. WELCH (*Montana Sta. Circ. 51 (1916), pp. 73–95, figs. 11*).—This is a summary of information, prepared for the stockmen of the State, which describes the more important poisonous plants to be avoided.

The nature of the disease due to the exclusive diet of oats in guinea pigs and rabbits, C. FUNK (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 409–416*).—Investigations were undertaken to study the effect of feeding oats to rabbits, guinea pigs, and rats, with special reference to the effect of the addition of sodium bicarbonate and the action of antiscorbutics.

It was found that the symptoms that develop in rabbits fed on oats are due possibly to acidosis and not to scurvy, judging from the beneficial effect of sodium bicarbonate and the ineffectiveness of the antiscorbutics. Guinea pigs on the same diet are not influenced by the alkali and respond so slightly to the action of antiscorbutics that the identity of this condition with human scurvy seems doubtful. Rats can live on oats for a considerable time, but not on autoclaved oats, and young rats fail to grow on this diet.

The effect of benzene on the production of antibodies, L. HEKTOEN (*Jour. Infect. Diseases, 19 (1916), No. 1, pp. 69–84, figs. 2*).—In the experiments reported injections of a mixture of benzene and olive oil in doses of approximately 1 cc. per kilogram of body weight into rabbits, at about the same time that sheep blood was injected, greatly reduced the production of specific precipitin and lysin. In considerably larger doses the same effect was observed on the production of lysin in white rats. "The reduction of antibody formation under these circumstances is associated with grave lesions in the marrow, with leucopenia, and other changes characteristic of benzene intoxication, the leucocytes in the rabbit being of reduced phagocytic power."

It is indicated that in the dog 0.02 cc. of benzene per kilogram of body weight may cause a leucocytosis associated with an increase of lysin for goat corpuscles. The course of antigen in the blood appears to be the same in benzenized as in nonbenzenized rabbits.

The injection of benzene at the height of antibody production appears to have but little effect on the leucocytes of the blood, and its antibody content, the precipitin especially persisting longer and with more fluctuation than otherwise.

"Benzene may lower the resistance to infection by reduction (1) of antibody production, (2) of the number of leucocytes, and (3) of leucocytic activity. That benzene acts on elements that elaborate antibodies, and that the leucocytogenic centers are concerned in this elaboration, is indicated (1) in the rabbit, by the reduction of antibodies and of leucocytes and by the resistance to these effects when antibody production is at or near its highest activity as measured by the concentration of antibodies in the blood, and (2) in the dog, when suitable doses are given, by leucocytosis and increased formation of lysin."

The coexistence of antibody and antigen in the body, B. S. DENZER (*Jour. Infect. Diseases, 18 (1916), No. 6, pp. 631–645, pls. 2, fig. 1*).—From the work reported it is concluded that antigen and antibody both in the cells and in the blood may be demonstrated during a period of three weeks succeeding the injec-

tion of a foreign serum into a guinea pig. After about 17 days the antigen apparently disappears from the cells and blood. Antibody is demonstrable in the cells from the ninth day onward, and in the blood after the fourteenth day.

"The interrelations of these four factors are probably very complicated. For a period of several days all may coexist in the body." The earlier observation that after partial desensitization both antigen and antibody may be demonstrated in the cells has been confirmed.

See also a previous note by Weil (E. S. R., 34, p. 778).

The effects of vaccine sensitized with homologous immune serum, as compared with those of a nonsensitized vaccine: An experimental study, S. KAKEHI (*Jour. Path. and Bact., 20 (1916), No. 4, pp. 410–443, figs. 5*).—From the investigation reported, using the *Bacillus pseudotuberculosis rodentium*, it was found that "the sensitized vaccine has one slight advantage in that the increase of temperature in injected animals is a little lower on the average than that produced by the nonsensitized, not only after the first injection, but also after succeeding injections."

In the use of the sensitized vaccine a much smaller loss of weight was observed than when the nonsensitized vaccine was used. No appreciable difference in the degree of immunity conferred by each kind of vaccine was noted, as about the same degree of resistance against various lethal doses was manifested by the animals when compared ten days after the last injection of vaccine.

"The production of antibodies in the serum, testable by agglutination and complement fixation, is much less with the sensitized than with the nonsensitized vaccine under the same conditions. Thus the estimation of these antibodies in vitro does not show the actual degree of immunity given by the former as compared with the latter."

A bibliography of 39 references to the literature cited is appended.

On Anaplasma-like bodies in the blood of vertebrates, ANNIE PORTER (*Ann. Trop. Med. and Par., 9 (1915), No. 4, pp. 561–568, figs. 10*).—"Anaplasmata may occur in healthy and in anemic vertebrate blood. The structures, also called marginal points and peripheral coccus-like bodies, are probably of diverse origin. It is doubtful if they are organismal in nature. Anaplasmata have been found by me in warm- and cold-blooded vertebrates, wherein conditions such as herpetomoniasis and anemia occurred. Some of the bodies originate from the nucleus of the erythrocyte or erythroblast, under the influence of hemolysis. The Anaplasma-like bodies were basophilic, apparently composed of chromatin or of a substance giving a similar staining reaction, and were homogeneous in structure. They varied from 0.3 to 2 μ in diameter, often being about 0.5 μ. Binary and multiple forms, which might be interpreted as phases of division, were seen."

Some experimental researches on induced herpetomoniasis in birds, H. B. FANTHAM and ANNIE PORTER (*Ann. Trop. Med. and Par., 9 (1915), No. 4, pp. 543–558, pl. 1*).—"Herpetomoniasis can be induced in birds, for example, canaries (*Serinus canarius*), sparrows (*Passer domesticus*), and martins (*Chelidon urbica*), by feeding them on insects containing herpetomonads. *Herpetomonas culicis* from *Culex pipiens* and *H. jaculum* from *Nepa cinerea* have fatally infected birds when fed to them. Both flagellate and nonflagellate herpetomonads have been found in the internal organs of the infected host. The cycle of the flagellates in the avian hosts resembled morphologically that in the insects. The disease induced may run an acute or a chronic course. In the acute cases in our birds the flagellate form of the parasite was the more obvious at death. In chronic cases, nonflagellate forms of the parasite were more numerous.

"Natural herpetomoniasis of a pigeon has been recorded by E. and Étienne Sergent in Algeria. This affords a parallel case with the natural and induced herpetomoniasis in mice previously recorded by us.

"The flagellate stage of *Leishmania donovani* in vertebrates is now known, and that of *L. tropica* in man has been known for some time. The links completing the evidence that a Leishmania is morphologically a Herpetomonas are thus complete. Leishmaniases are really herpetomoniases (or leptomoniases) arising from herpetomonads of certain invertebrates. Members of all classes of vertebrates may be capable of acting as reservoirs of herpetomoniasis, and the virus may exist in a very attenuated condition and so be difficult of detection."

The cause of rat-bite fever, K. FUTAKI, F. TAKAKI, T. TANIGUCHI, and S. OSUMI (*Jour. Expt. Med., 23 (1916), No. 2, pp. 249, 250, pl. 1*).—A report of a systematic study made of two cases of rat-bite fever which recently came under observation. An India ink preparation of the exudate of a swollen lymph gland of one of the patients, made according to the method of Burri, and a section of the excised lymph gland impregnated with silver according to Levaditi's method, both showed the presence of a spirochete somewhat larger than *Spirochæta pallida* but smaller than *S. duttoni* and *S. obermeieri*. Both patients recovered, one after treatment with mercury and the other with salvarsan.

Isolation and cultivation of Bacterium tuberculosis on a synthetic culture medium, C. A. MAGOON (*Washington Sta. Bul. 132 (1916), pp. 3–9*).—The author reports some results obtained in a study of the metabolism of *Bacillus tuberculosis* by cultivating the organism on a culture medium of the following definite chemical composition: Ammonium phosphate (dibasic), 1.75 gm.; potassium phosphate (dibasic), 0.25 gm.; sodium phosphate (dibasic), 0.5 gm.; magnesium sulphate, 0.5 gm.; glycerin, 20 cc.; and distilled water, 1,000 cc. Special precautions necessary in the preparation of the medium are outlined in detail.

In preliminary tests to determine the suitability of the solution as a culture medium, *B. subtilis*, *B. mycoides*, *B. prodigiosus*, *B. coli*, *B. cholera suis*, *B. pyocyaneus*, and *Staphylococcus pyogenes aureus* all showed prompt and abundant growth. Inoculation of the medium with *B. tuberculosis* was followed by a vigorous growth which appeared in two days. Marked differences in the cultural characteristics of the bovine and human strains of the tuberculosis bacillus were noted as growth progressed.

In isolation experiments made from lesions of guinea pigs previously inoculated from a pathological laboratory culture of the bovine type positive results were obtained in 80 per cent of the trials made, the growth appearing in seven days from the time of inoculation. Pure cultures were also obtained in isolation experiments from the liver of a turkey spontaneously infected. Human strains of the micro-organism have been cultivated from lesions of guinea pigs inoculated with sputum with favorable results. While positive isolations have not been constant the work has been carefully checked.

"The practical value of this synthetic medium as a means of isolating the organism from tuberculous lesions is yet to be determined. As has been emphasized by other investigators the value of synthetic media in the study of the metabolism of the organism, and especially in the preparation of tuberculins free from heterogeneous albuminoids, is very great. Preliminary examinations of our rapidly growing cultures has shown them to possess marked antigenic properties, and their use in serological work shows much promise."

It is stated that investigations as to the value of these cultures in serum diagnosis are being pursued.

On certain reactions of the tubercle bacillus to sperm oil and its constituents, A. H. MILLER (*Jour. Path. and Bact., 20 (1916), No. 4, pp. 395–407, pl. 1*).—The work reported confirms the earlier observation that the tubercle bacillus grown on sperm-oil media is converted into "banded" and "beaded" forms. The same conversion is also shown in its first stages of growth on an olive-oil medium. Such forms are not observed in bacilli grown on glycerin-egg, glycerin-agar, cetyl alcohol, cetyl palmitate, and palmitic acid media.

It is deemed probable that the "banding" and "beading" is due, "in part at least, to the presence of unsaturated fatty acids in the form of esters."

Notes on the chemistry of sperm oil, by A. R. Smith, are included.

Tubercular antibodies and their rôle in the defense of the organism against tubercular infection, A. CALMETTE and L. MASSOL (*Bul. Inst. Pasteur, 14 (1916), Nos. 2, pp. 33–40; 3, pp. 65–74; 4, pp. 97–104*).—This is a general review of the subject, together with some experimental observations made by the authors, and is treated under the following topics: Preparation of a serum for research and the titration of the antibodies; choice and preparation of the antigen and determination of its value; antigenic properties of the organs, exudates, pus, and glandular excretions of tubercular subjects; researches on the titration of antibodies in the serum of tubercular patients; procuring a serum rich in antibodies; the inhibiting reaction of certain sera of hypervaccinated tubercular animals on the complement-fixation reaction; researches on the antibodies in the organ extracts and exudates of tubercular subjects; hereditary transmission of tubercular antibodies; the diagnostic and prognostic importance of the titration of the antibodies in tubercular infections; and the function of the antibodies in the defense of the organism against tubercular infection.

Protective inoculation of live stock in India, A. W. SHILSTON (*Agr. Jour. India, 11 (1916), No. 2, pp. 112–133*).—This article gives a short account of the initiation of prophylactic measures against animal diseases in India, and discusses the prevalence and treatment of rinderpest, hemorrhagic septicemia, true anthrax, black quarter of cattle and sheep, and tetanus.

Infectious abortion in cattle, W. GILTNER and E. T. HALLMAN (*Michigan Sta. Circ. 29 (1916), pp. 13*).—A summary of the present status of the knowledge of this disease of cattle and of control measures, prepared in response to a demand for information by dairymen of the State. The plan for control suggested by the authors is that of local treatment of the affected cow, disinfection, and sanitation.

The immunization of Egyptian cattle against rinderpest by simultaneous treatment with serum and virulent blood. Duration of immunity, PIOT (*Ann. Inst. Pasteur, 30 (1916), No. 4, pp. 187–194*).—The author reports successful results of immunization tests with Egyptian cattle and recommends a systematic vaccination of cattle in all the Provinces of Egypt.

The procedure used in the simultaneous treatment and the clinical manifestations after the treatment are described in detail.

The immunity conferred in most cases was absolute, with a mortality in treated animals of less than 1 per cent.

The antigenic value of Spirochæta hyos in complement-fixation tests on hog-cholera sera. Studies on hog cholera, W. E. KING and R. H. DRAKE (*Jour. Infect. Diseases, 19 (1916), No. 1, pp. 46–62, figs. 5*).—"Antigen prepared from *S. hyos* grown in pure culture possesses well-marked specific complement-binding properties. This antigen, when brought into contact with the sera of experimentally infected cholera hogs, produces initial complement fixation at a period coincident with completion of the incubation period as observed in clinical conditions and thermal reactions. The specific properties of the antigen are shown to be present until death of the animal, or until active immunity is fully

established. The sera of normal hogs and those experimentally infected with *Bacillus cholera suis*, the Ghon-Sachs bacillus, *B. anthracis*, *Staphylococcus aureus*, and also the serum of one hog which was the subject of pneumonia from natural exposure and which died from acute brine poisoning, all reacted negatively when tested for complement fixation with *S. hyos* antigen."

It is deemed that with the proper technique the method may be used to practical advantage as a reliable, accurate means of laboratory diagnosis of hog cholera. "The results of these experiments support our former conclusions that *S. hyos* merits serious consideration as an organism possessing specific pathogenic properties in relation to hog cholera."

Swine tuberculosis: Epidemiology, pathogeny, and comparative evolution, P. CHAUSSÉ (*Ann. Inst. Pasteur, 29 (1915), Nos. 11, pp. 556–600, figs. 17; 12, pp. 633–647, figs. 5*).—The author discusses the subject of swine tuberculosis in detail. Topics considered are the relative morbidity of bovine and porcine tuberculosis, paths of infection in swine, tonsillar and cervical lymphatic infection, intestinal infection, mixed infection, respiratory infection, tuberculosis through castration, the lesions in tubercular swine, a histological study of the lesions with special reference to the pulmonary lesions, and a comparison of swine tuberculosis with that of other species, especially in regard to the pathogenicity.

A study of gas production by different strains of Bacillus abortive-equinus, E. S. GOOD and L. S. CORBETT (*Jour. Infect. Diseases, 18 (1916), No. 6, pp. 586–595*).—Continuing earlier studies at the Kentucky Experiment Station on the organism (E. S. R., 27, p. 580), it was found that in 93 out of 116 trials *B. abortivo-equinus* produced approximately 2 per cent gas in lactose and slightly less than 2 per cent in 28 out of 56 trials in saccharose.

The average gas production by the strain of *B. enteritidis* was about 2 per cent in lactose in 80 per cent of the trials and a slightly smaller amount in saccharose in 1 of 7 trials. The strain of the paracolon bacillus used in these experiments did not ferment lactose or saccharose.

"*B. abortivo-equinus* may or may not produce gas in 1 per cent lactose or saccharose broth, even varying in this respect in duplicate and triplicate tests. *B. abortivo-equinus* possesses as an original physiological characteristic the ability, in most cases, to ferment lactose to a small extent, and also, in some cases, to ferment saccharose to a less extent. This characteristic in all probability has not yet been accentuated by environment. Lactose and saccharose broth can be employed to good advantage in laboratory routine for differentiating *B. abortivo-equinus* from the colon bacillus, as the gas, when produced, is small in amount; and, in all probability, dulcite and perhaps raffinose can be used to advantage in differentiating *B. abortivo-equinus* from other members of subgroup 2 of the colon-typhoid group, but absolute proof as to its identity can only be secured through the use of other tests, such as those for further cultural characteristics and the complement-fixation and agglutination tests."

In the work reported the inverted vial was found to be as efficacious as the Smith fermentation tube.

Sclerostomes in horses, W. J. HARTMAN (*Montana Sta. Circ. 58 (1916), pp. 221–236, figs. 8*).—The author, having found this parasite to be a source of considerable loss in the Bitter Root and other valleys of the State, presents a general account of it and of the nature of the affection. It is thought that 95 per cent of the horses in the valleys are infected with the worms, though probably not more than one in ten develops noticeable symptoms.

Concerning nambi-uvu, a disease of dogs, and the causative parasite, Rangelia vitalii, A. CARINI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 77 (1915), No. 3, pp. 265–271, pls. 2*).—The author describes a severe infectious disease of

dogs that occurs in Brazil and is commonly known as nambi-uvu, which appears in acute or icteric, subacute or hemorrhagic, and chronic or mild, forms. The disease is caused by *R. vitalii*, a parasite belonging to the family Piroplasmidæ.

Tuberculosis of poultry, H. WELCH (*Montana Sta. Circ. 57 (1916), pp. 209–219 figs. 7*).—This circular discusses the subject of avian tuberculosis under the general topics of birds affected, nature of the disease, detection of the disease, post-mortem appearance, sources of infection, tuberculin testing, and eradication of tuberculosis.

RURAL ENGINEERING.

Hydraulics, R. L. DAUGHERTY (*New York and London: McGraw-Hill Book Co., 1916, pp. XIV+267, figs. 245*).—This is a brief treatise on the fundamental principles of hydraulics. It contains the following chapters: Introduction, intensity of pressure, hydrostatic pressure on areas, applications of hydrostatics, hydrokinetics, application of hydrokinetics, flow through pipes, uniform flow in open channels, hydrodynamics, description of the impulse wheel, description of the reaction turbine, water power plants, theory of the impulse wheel, theory of the reaction turbine, turbine laws and factors, and the centrifugal pump.

An appendix of tabular data is included.

Hydraulics and its applications, A. H. GIBSON (*New York: D. Van Nostrand Co., 1915, 2. ed., rev. and enl., pp. XVII+813, figs. 399*).—This book is intended as a text-book for students and a reference book for practicing engineers, and deals with hydraulics and its application to the design of hydraulic machinery. It is divided into sections on the physical properties of water, hydraulics, and hydraulic machinery and contains 21 chapters on different phases of these subjects. An appendix of hydraulic tables and data is included.

Water power engineering, D. W. MEAD (*New York: McGraw-Hill Book Co., 1915, 2. ed., pp. XVII+843, figs. 439*).—This book covers the theory, investigation, and development of water powers. It contains the following chapters:

Power, the load, the flow of streams, the measurement of stream flow, a study of the power of a stream as affected by flow, pondage, storage, and head, water wheels, turbine details, and appurtenances, hydraulics of the turbine, turbine testing, turbine analysis and selection, speed regulation of turbine water wheels, the water wheel governor, arrangement of the reaction wheel, selection of machinery and design of the plant, examples of water power plants, the relation of the dam and power station, principles of construction of dams, appendages to dams, cost of power plants and of power, financial and commercial considerations, and the consideration of water power projects.

Practical methods of measuring flowing water, C. O. WISLER (*Engin. and Contract., 45 (1916), No. 24, pp. 536–539*).—"The object of this paper is to give a brief résumé of the different methods commonly employed in the measurement of flowing water, drawing attention to those purposes for which each method is best adapted and, finally, discussing in more or less detail some of the most important methods used in flow measurement."

Tests of loss of head in strainers, orifices, and sand, L. PEARSE (*Jour. Amer. Water Works Assoc., 3 (1916), No. 2, pp. 504–513, pl. 1, figs. 6*).—The results of tests of the loss of head in strainers used in rapid filters and in small orifices are reported in tabular and graphic form.

Earth pressure, retaining walls, and bins, W. CAIN (*New York: John Wiley & Sons, 1916, pp. X+287, figs. 99*).—This book contains the following chapters: Laws of friction and cohesion—tables, direction, and distributon of stress; thrusts of noncoherent earth—graphical methods; noncoherent earth—analyti-

cal methods; designing retaining walls of stone or reinforced concrete; coherent earth; and bin theory. Two appendixes are included on stresses in wedge-shaped reinforced concrete beams and a discussion of experiments on model retaining walls.

Reports of the Board of Engineers Flood Control to the Board of Supervisors, Los Angeles County, California (*Los Angeles: Bd. Engin. Los Angeles Co., 1915, pp. 400 pls. 21, figs. 189*).—The text of the report, with maps, plans, specifications, and estimates, is given.

The laws of Indiana for constructing ditches and levees and on stream pollution and flood prevention, 1915 (*Indianapolis, Ind.: State, 1915, pp. 368*).—The text of the laws is given.

Surface water supply of Snake River basin, 1913 (*U. S. Geol. Survey, Water-Supply Paper 362—B (1916), pp. 290*).—This report, made in cooperation with the States of Idaho, Oregon, and Washington, presents the results of measurements of flow made on the Snake River and its tributaries during 1913.

Running water for farm homes, D. Scoates and J. W. Carpenter, Jr. (*Miss. Agr. Col. Ext. Dept. Circ. 6 (1916), pp. 15, figs. 6*).—This is a popular discussion with bills of material for four water-supply systems adapted especially to the needs of Mississippi farms. These vary in approximate cost from $18.40 to $128.80.

Sources of water pollution, J. W. Hill (*Jour. Amer. Water Works Assoc., 3 (1916), No. 1, pp. 184–191*).—The author discusses, from his own experience, the difficulties attending the selection of satisfactory sources of water supplies.

The latest method of sewage treatment, E. Bartow (*Jour. Amer. Water Works Assoc., 3 (1916), No. 2, pp. 327–345, figs. 8*).—This is a review of a number of recent reports of experimental work on the subject, many of which have been noted from other sources.

Sewage purification plants for small country residences and isolated buildings, A. P. I. Cotterell (*Jour. Roy. Sanit. Inst., 37 (1916), No. 2, pp. 59–69, figs. 5*).—The general features of the subject are discussed.

The utilization of ground waters by pumping for irrigation, G. E. P. Smith (*[Tucson, Ariz.: Author, 1915], pp. 31, figs. 7*).—The purpose of this paper "is to present in brief compass a survey of modern irrigation pumping and a retrospect of the progress of the past ten years. [It] treats briefly of ground-water supplies, their occurrence, regimen, and recharge; of the methods of developing ground-water supplies by means of wells; of pumping machinery; and of the economics of this type of irrigation. It is a discussion of what is, and not of what ought to be; and a mention of new things rather than a description of the old."

Curves for irrigation-ditch velocity and discharge, L. R. Douglass (*Engin. News, 76 (1916), No. 2, pp. 72, 73, figs. 2*).—Two sets of curves are given which were prepared primarily for use in irrigation-ditch computation.

Some studies on the irrigation of citrus orchards, R. S. Vaile (*Univ. Cal. Jour. Agr., 3 (1916), No. 8, pp. 329–332, figs. 3*).—Studies of the amounts of water delivered to groves, including a comparison of distribution under various methods of application and culture, are reported.

It was found that "a very much higher efficiency has been obtained with the overhead irrigation than with the furrow irrigation," but the conclusion drawn from these results "would not necessarily be in favor of overhead irrigation as a general practice. It would rather be to point out the necessity for care in furrow irrigation."

Moisture determinations from composite soil samples of the first 4 ft. in clean cultivated and mulched portions of the same orchard showed "that

the maximum, minimum, and mean for the mulched section were all much higher than for the clean cultivated section. This was especially true in the earlier part of the season when the mulch was heavy. Later on, the straw became somewhat dissipated, and the moisture was not retained as well as earlier in the season. One considerable factor in the higher average under the mulch was that all of the ground was uniformly moist; while in the case of furrow irrigation the ground in the tree rows received very little benefit from irrigation."

Text-book of land drainage, J. A. Jeffery (*New York: The Macmillan Co., 1916, pp. XX+256, figs. 95*).—This book, prepared mainly for the practical farmer, represents an attempt "to put into simple and concise terms the fundamentals of our knowledge concerning the relation of water to agriculture and of the relation of drainage to soil water." It contains the following chapters: Characteristics of soils, physical interrelations in soils, humid areas and their reclamation, general drainage information, leveling, laying out a drain or system, construction, other conditions and problems, the hose level, using the hose level without leveling rods, drainage indications, drainage and the groundwater supply, drainage and climate, and drainage laws.

An appendix describes 18 experiments prepared to demonstrate some of the more important facts concerning soil conditions and drainage.

The drainage of white land and other wet lands in Oregon, W. L. Powers and T. A. H. Teeter (*Oregon Sta. Bul. 137 (1916), pp. 80, figs. 43*).—"This bulletin describes experiments to determine the most suitable depth, distance apart, and size for field drains in white land, and also gives information regarding the drainage situation in Oregon in general. There is in the State a great variety of wet lands of which three classes [predominate], namely, white land, marsh land, and alkali land. Drainage of much of this wet area appears to be feasible, as good quantities of plant food and friable layers have been found therein. . . .

"Studies of subsoil and ground water in white land generally show a friable streak at 33 to 36 in. depth and show also that tile placed in these areas have lowered the water table most promptly. The water table is lowered for 25 to 30 ft. back from the tile within 24 hours after saturation.

"A depth of 33 to 36 in. has been found most effective for lateral drains in typical white land, while deeper drains are desirable in the less retentive areas. An interval of 60 to 66 ft. between laterals affords the most practical drainage for typical white land under present conditions, and this distance may be increased in less retentive phases of this soil.

"Measurements of outflow indicate that main drains should have a capacity of ½ acre-inch run-off to the acre in 24 hours for areas up to 40 acres and ⅓ in. for larger fields. The total and percentage run-off in the Willamette Valley is large.

"Since drainage is costly and white land subsurface is retentive, farm operations should aim to aid water in entering the tile. When drained fields are in clover a larger outflow from tile and less surface water have been observed, and the structure and fertility of the land gradually improves.

"Reports from farmers having over 100 miles of tile in operation in the white land and other wet land in the valley show that tiling has generally been successful. The tendency is toward larger tile in place of small open ditches. A combination of tile with a surface run is good practice. Nature has determined the general location of ditches, and the size of the natural channel is an index to the required capacity. The grade should be low enough to receive the discharge from all laterals."

Important features of the state drainage law are also noted.

Blasting ditches, H. E. Murdock (*Montana Sta. Circ. 55 (1916), pp. 185–192, figs. 7*).—This circular gives data secured on blasting open drainage ditches on the station farm at Bozeman, Mont. The soil is very gravelly and contains many large rocks, making digging difficult and expensive.

"In the blasted ditch two sticks of 60 per cent dynamite were placed in holes 22 in. apart. This distance was determined by experimenting to be the most desirable for the soil conditions. When the holes were spaced 22 in. or less ordinarily only one charge was needed for a primer, as the others would be exploded by concussion. When spaced farther apart some holes would mis-fire, When spaced less than 22 in. there was a waste of dynamite, as there was no additional benefit to the ditch. The holes were driven by tool-steel bars 2.5 ft. long. . . . In the work done in 1914 the holes were spaced 20 in. apart and electric caps and a blasting machine were used."

"A comparison of three lengths of ditch constructed in 1915 is as follows: Fourteen rods of hand-dug ditch cost $3.35 per rod, 17 rods of blasted ditch $3.10 per rod, and 39.2 rods of blasted ditch $2.36 per rod.

First biennial report of the state highway commission [of Idaho] for the period ending December 31, 1914 (*Bien. Rpt. State Highway Com. Idaho, 1 (1914), pp. 81, pls. 25, fig. 1*).—The work and expenditures on roads in Idaho for the biennium ended December 31, 1914, are reported.

Annual report of the highways division [of Nova Scotia] for the year ended September 30, 1915, H. Donkin (*Ann. Rpt. Highways Div. Nova Scotia, 1915, pp. 97, pls. 9, fig. 1*).—Data on the work and expenditures on roads in Nova Scotia for the year ended September 30, 1915, are presented in detail.

Constitution and statutes of the State of Oregon relating to roads, highways, bridges, and ferries, compiled by B. W. Olcott (*Salem, Oreg.: State Print. Dept., 1915, pp. 221*).—The text of the legislation is given.

A handy road chart, N. G. Near (*Engin. and Contract., 46 (1916), No. 1, p. 21 fig. 1*).—A chart for the use of road builders in determining the number of square yards in any road up to nearly 2 miles in length and in any width up to 1,000 ft. is given.

Minimum tire widths for good roads, H. L. Hock (*Cornell Civ. Engin., 24 (1916), No. 9, pp. 469–475, figs. 3*).—In a brief review of the laws and technical data on the subject the author recommends "the adoption of a law which shall permit a maximum load of 250 lbs. per inch width per tire, if the tire is of wood, metal, or other hard material; and 300 lbs. per inch width per tire if of rubber or other resilient material."

Some comparative tests of wire-cut-lug and repressed paving brick, W. A. Goss (*Engin. and Contract., 46 (1916), No. 1, pp. 8–11, figs. 2*).—Abrasion, standard abrasion, standard absorption, specific gravity, cross bending, compression, shear and impact tests conducted at the University of Wisconsin on wire-cut-lug and repressed paving brick, are reported.

"The determinations arrived at as a result of these tests are that the wire-cut-lug bricks have better abrasive and wearing qualities, greater density, greater crushing strength; the repressed brick have greater weight per unit volume, greater toughness. . . . In addition the wire-cut-lug brick are of more uniform quality than the repressed.

"The tests show that both types of the brick tested were of good quality for paving purposes. Either brick is plenty strong and tough enough for use in a pavement. The difference in wearing qualities and in uniformity are the most important determinations of these tests, and in these characteristics the wire-cut-lug brick have shown superiority. This difference is not marked, however, and it would be necessary to test out brick from other plants before one could state just what degree of difference exists."

Strength and other properties of concretes as affected by materials and methods of preparation, R. J. Wig, G. M. Williams, and E. R. Gates (*U. S. Dept. Com., Bur. Standards Technol. Paper 58 (1916), pp. 172, pls. 2, figs. 44*).—The results of about 20,000 tests, consisting of compressive and tensile tests upon mortars at different ages including about 240 different sands and stone screenings, and compressive tests on concretes composed of 60 aggregates including limestones, gravels, granites, cinders, and trap rock, are reported together with tests of the physical properties of the sands, stone screenings, and coarse aggregates. The following conclusions are drawn:

"No standard of compressive strength can be assumed or guarantied for concrete of any particular proportions made with any aggregate unless all the factors entering into its fabrication are controlled.

"A concrete having a desired compressive strength is not necessarily guarantied by a specification requiring only the use of certain types of materials in stated proportions. . . . The compressive strength of a concrete is just as much dependent upon other factors, such as careful workmanship and the use of the proper quantity of water in mixing the concrete, as it is upon the use of the proper quantity of cement.

"The compressive strength of concrete may be reduced by the use of an excess of water in mixing to a fractional part of that which it should attain with the same materials. . . . The compressive strength of concrete may be greatly reduced if, after fabrication, it is exposed to the sun and wind or in any relatively dry atmosphere in which it loses its moisture rapidly, even though suitable materials were used and proper methods of fabrication employed. The relative compressive strength of concretes to be obtained from any given materials can be determined only by an actual test of those materials combined in a concrete.

"Contrary to general practice and opinion the relative value of several fine aggregates to be used in concrete can not be determined by testing them in mortar mixtures. They must be tested in the combined state with the coarse aggregate.

"Contrary to general practice and opinion the relative value of several coarse aggregates to be used in concrete can not be determined by testing them with a given sand in one arbitrarily selected proportion. They should be tested in such combination with the fine aggregate as will give maximum density, assuming the same ratio of cement to total combined aggregate in all cases.

"No type of aggregate such as granite, gravel, or limestone can be said to be generally superior to all other types. There are good and poor aggregates of each type. By proper attention to methods of fabrication and curing, aggregates which appear inferior and may be available at the site of the work may give as high compressive strength in concrete as the best selected materials brought from a distance, when the latter are carelessly or improperly used.

"Density is a good measure of the relative compressive strength of several different mixtures of the same aggregates with the same proportion of cement to total aggregate. The mixture having the highest density need not necessarily have the maximum strength, but it will have a relatively high strength.

"Two concretes having the same density, but composed of different aggregates, may have widely different compressive strength. There is no definite relation between the gradation of the aggregates and the compressive strength of the concrete which is applicable to any considerable number of different aggregates. The gradation curve for maximum compressive strength, which is usually the same as for the maximum density, differs for each aggregate.

"With the relative volumes of fine and coarse aggregate fixed, the compressive strength of a concrete increases directly, but not in a proportionate ratio as the cement content. An increase in the ratio of cement to total fine and coarse aggregates when the relative proportions of the latter are not fixed does not necessarily result in an increase in strength, but may give even a lower strength.

"The compressive strength of concrete composed of given materials combined in definite proportions and fabricated and exposed under given conditions can be determined only by testing the concrete actually prepared and treated in the prescribed manner. . . . The compressive strength of most concretes as commercially made can be increased 25 to 100 per cent or more by employing rigid inspection, which will insure proper methods of fabrication of the materials."

The composition of the exhaust from liquid-fuel engines, R. W. FENNING (*Jour. Inst. Mech. Engin.* [*London*], *No. 4,* (*1916*), *II, pp. 185–236, figs. 9; Gas Engine, 18* (*1916*), *Nos. 5, pp. 242–258, figs. 6; 6, pp. 287–289, figs. 3*).—With reference to the practice of analyzing the exhaust gases of internal combustion engines to determine the completeness of combustion and the probable strength of the air fuel mixture supplied, a method of constructing exhaust gas charts for suitable fuels without the use of an engine is described and the results of numerous experiments relating thereto reported. The experiments consisted of a comparison of the composition of the products of combustion of prepared mixtures of air and vaporized fuel in known proportions exploded in a small vessel with the composition of the exhaust gases from an internal-combustion engine.

From the results of these experiments it is concluded that "with volatile fuels there is but little difference in the composition of the products of combustion resulting from air-fuel mixtures in a small explosion vessel or in an engine cylinder in spite of the conditions being so dissimilar. The agreement between the CO_2, O_2, and CO values in engine and explosion vessel tests is so close that an exhaust gas chart prepared from explosion vessel tests can be used to estimate the strength of mixture supplied to an engine. A very small quantity, if any, of unsaturated or saturated hydrocarbons is present in engine exhaust gases. Taking a particular instance, methane is almost entirely absent. The hydrogen constituent in exhausts from strong mixtures is an important item and increases in value rapidly with increase in mixture strength. The ratio of air to fuel in the original mixture can be calculated with a considerable degree of accuracy from the composition of the exhaust gases."

[Tractor specifications], P. S. ROSE (*Amer. Thresherman, 19* (*1916*), *No. 3, pp. 1–4, 6, figs. 2*).—A table of specifications for 144 tractors of 91 different makes is given, together with two diagrams showing arrangements of tractor wheels and styles of motors.

[Drawbar pull of tractor], R. OLNEY (*Power Farming, 25* (*1916*), *No. 5, pp. 7–9, figs. 2*).—This article discusses the drawbar rating of tractors in terms of horsepower and gives a set of curves and a table of data showing tractor speed in miles per hour, drawbar pull in pounds, and drawbar horsepower based on the formula $\text{Horsepower} = \dfrac{\text{pounds pull} \times \text{speed in miles per hour}}{375}$.

The construction of the dairy house, H. A. RUEHE (*Illinois Sta. Circ. 188* (*1916*), *pp. 8, figs. 4*).—The general principles to be followed in dairy house construction and equipment are presented by discussion and diagrammatic illustrations.

How to build a hollow tile silo (*Brick and Clay Rec.*, *48* (*1916*), *No. 12*, *pp. 1116–1118*, *figs. 5*).—Instructions, with diagrammatic illustrations, for this work are given.

Poultry houses for Georgia, R. F. Irvin (*Bul. Ga. State Col. Agr.*, *No. 96* (*1915*), *pp. 8*, *pls. 4*, *figs. 5*).—This bulletin points out the general requirements of a good poultry house and describes and illustrates three types designed with reference to Georgia conditions.

The Missouri poultry house, H. L. Kempster (*Missouri Sta. Circ. 80* (*1916*), *pp. 8*, *figs. 5*).—This circular describes and illustrates the Missouri poultry house, giving bills of material and costs.

"Since the average farm poultry flock in Missouri is from 100 to 150 hens, this house is 20 ft. square, the square house being the most economical to construct and affording a maximum amount of floor space. The ridge of the roof runs north and south, the roof being of equal spans. The walls are 5 ft. at the eaves. It is 11 ft. high at the peak. The south side contains a door in the center and a window 2 by 3 ft. on each side of the door. These windows are placed high enough to afford a 30-in. opening beneath, 1 ft. above the floor and extending the entire length each side of the door. This opening is covered with wire screen, which keeps the hens in and the sparrows out."

Details of a trap nest are also included.

RURAL ECONOMICS.

A preliminary study of the marketing of Burley tobacco in central Kentucky, C. D. Bohannan and D. P. Campbell (*Kentucky Sta. Bul. 202* (*1916*), *pp. 157–244*, *pls. 8*, *figs. 10*).—This is the first of a projected series of studies on the marketing of Kentucky farm products.

The culture and curing of Burley tobacco, which is now the greatest cash crop of the blue grass region, is briefly explained, the methods of marketing described in detail, and the relative profits of those handling the crop discussed.

"Formerly the tobacco was shipped in hogsheads to Louisville or Cincinnati or sold in the barn to the buyer for one of the tobacco companies. Now it is, as a rule, sold at auction over the loose-leaf floors, although some crops are purchased in the barns by speculators.

"The greater part of each season's crop, of which during the last season 35,000,000 lbs. were sold in Lexington, is purchased by the agents or 'buyers' for the large tobacco manufacturers. . . . After sale to a buyer or broker the leaf is usually repicked, redried, and prized into hogsheads for shipping or storage."

The loose-leaf system is stated to be the most economically efficient system yet devised. It is, however, "susceptible of improvement in elimination of waste product and duplication of effort. From the standpoint of both grower and manufacturer there is much need of improvement in curing methods and in the grading of the leaf as it comes from the stalk. . . .

"Proper grading applies with peculiar force to Burley tobacco. Approximately 60 per cent of the total amount of tobacco sold over the Lexington floors is capable of improvement by rehandling and resorting. This improvement would result in raising the price at least 2 cts. per pound."

The need of a state marketing law and the use of standard grades for all farm products, which permits of division into grades, and for standard receptacles for products sold in containers is set forth. "No product not graded in accordance therewith should be permitted to be exposed or offered for sale

unless specifically described as not graded or placarded in legible letters 'not graded.' To facilitate the placing of blame for improperly graded leaf, contract strippers should be required to obtain a license bearing a registered number and certifying to their ability in grading tobacco."

Disadvantages of selling cotton in the seed, C. F. CRESWELL (*U. S. Dept. Agr. Bul. 375 (1916), pp. 18*).—The results of an investigation conducted in Oklahoma in 1913–14 to ascertain the relative advantages and disadvantages accruing to the farmer from selling seed cotton instead of marketing the seed and the baled lint separately are reported. A study was made of 881 10-lb. samples collected from as many different loads sold by different farmers in nine representative seed-cotton markets. The samples were ginned and carefully graded, and the results obtained are tabulated and discussed.

The examination of the samples indicated that the average lint outturned for the season in the districts covered by the survey was approximately 31.5 per cent. The seed cotton samples secured in the nine different towns showed an average variation of 14.3 per cent in lint, 27.5 per cent in seed, and 25.2 per cent in trash content. Tables are given showing that wide variations in qualities and outturns of seed cotton exist in the same market on the same day, and that these variations result in marked inconsistencies in equivalent lint prices when a uniform price is paid for seed cotton regardless of its quality. It is further shown that the custom of selling seed cotton resulted in wide variations between the prices received for the same quality of lint cotton in the same market during the same week.

Observations on the prices for each grade during the season throughout the State showed a loss on each grade when the cotton was sold unginned, the loss being larger on the higher grades than on the lower ones. A comparison by months between prices secured for cotton when sold unginned and when sold in the bale during the entire season in the markets represented, indicate a loss for each month ranging from an average of $3.85 per bale in October, to $10.25 per bale in December. The average baled lint price for the entire season was 11.7 cts., and the average equivalent lint price for the entire season 10.2 cts.

In a study of conditions in a specific locality it was found that $3.95 more per bale was paid for Triumph than for other cotton. It is pointed out that on each pound of cotton sold unginned in this market the growers sustained an average loss of 1.01 cts., or $5.05 on each bale.

The supply and price of wheat, H. HITIER (*Ann. Sci. Agron., 4. ser., 4 (1916), No. 10–12, pp. 254–273*).—The author discusses the production and consumption of wheat in the principal producing countries and the prices at the principal market centers for 1915, with comparisons for earlier years.

Foreign trade in agricultural products, 1913, O. BORDIGA (*Atti R. Ist. Incoragg. Napoli, 6. ser., 66 (1914), pp. 35–77*).—This report compares the imports and exports of agricultural products for 1913 with earlier years as to source, destination, and kind.

The system of land registration in New Zealand, G. G. BRIDGES (*Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Agr. Econ., 7 (1916), No. 4, pp. 92–112*).—This article gives a general description of the methods used in conveying land, including the system of transfer, registration of dealings, attestations of instruments, and surveys, together with forms used in the different transactions.

Agricultural labor and wages (*Lantarbetarnas Arbets-och Löneförhållanden inom olika Bygder och å typiska lantegendomar. Stockholm: Dept. Labor, 1915, pp. 412; rev. in Internat. Inst. Agr.* [*Rome*], *Internat. Rev. Agr. Econ., 7 (1916), Nos. 2, pp. 113–125; 3, pp. 106–123; 4, pp. 113–117*).—This is a special report concerning agricultural laborers in Sweden, and discusses the classes of holdings, types of farming, number and distribution of the agricultural popula-

tion, terms of employment, wage systems, grants of land to agricultural laborers, and labor conditions on certain typical holdings. Information is also given concerning the duration of work and the kind and rate of wages for the different classes of agricultural workers.

Farmers' cooperative electricity societies, C. L. Stewart (*Wis. Country Mag., 10 (1916), No. 9, pp. 434, 435, 468*).—The author states that the conclusion reached by cooperative leaders is that electricity societies should seldom build their own overland central stations, but that they should by all means be assured of sufficient custom. The average membership in societies owning their power works is between 300 and 400, and it is best for the membership to go into four figures if small farmers predominate.

Proceedings of the Seventh Provincial Conference of Cooperative Societies in Bengal (*Proc. Prov. Conf. Coop. Socs. Bengal, 7 (1915), pp. II+74+XXXVIII, pl. 1*).—Among the topics discussed at this conference, held at Calcutta in February, 1915, were those relating to the different phases of rural credit, cattle insurance, and cooperative dairying.

The rural home and the farm woman, D. B. Johnson (*School and Soc., 4 (1916), No. 80, pp. 39–42*).—The author states that "it is not sufficient to give the farm woman all of the conveniences of a model home. Country life must be made socially satisfying. In order for country life to be financially and socially satisfying the people must have education and own their homes, must cooperate with each other in rural community activities, and must have rural community organization for the promotion and support of an educational, religious, social, business, and intellectual community life."

Staircase farms of the ancients, O. F. Cook (*Nat. Georgr. Mag., 29 (1916), No. 5, pp. 474–534, figs. 48*).—In this article are described the type of agriculture, principal crops grown, and methods of managing the land practiced by the early inhabitants of Peru, as disclosed by a study of the remains of their hanging gardens and other prehistoric evidences.

Egypt of the Egyptians, W. L. Balls (*New York: Charles Schribner's Sons, 1916, pp. XVI+266, pls. 33, figs. 2*).—The author describes the methods of controlling the water of the Nile for irrigation purposes and its influence upon the agriculture of the country, the methods of growing crops, and the types of agricultural people.

Greater agricultural efficiency for the Black Belt of Alabama, C. E. Allen (*Ann. Amer. Acad. Polit. and Soc. Sci., 61 (1915), No. 150, pp. 187–198, figs. 1*).—The author compares the agricultural conditions in the Black Belt with the regions immediately adjacent where the whites are in the majority.

He points out that the Black Belt contains a soil more fertile and more adapted to the cultivation of staple crops, yet the average production of cotton per acre was 0.27 bale and 10.4 bu. corn in the Black Belt as compared with 0.34 bale and 11.4 bu., respectively, for the adjacent areas. In the "white" area the value of improvements is increasing more rapidly, more land is being brought into cultivation, and the rural population is increasing, while in the Black Belt there is a decrease in the area of cultivated land and in the rural population.

The author believes that the problem resolves itself into one of improving rural conditions of living so that rural life will become attractive by the establishment of improved highways, cooperative agencies, and better educational facilities, to be followed by efforts to teach the negroes scientific agriculture.

Farm management or what can be done on a fifty acre farm in east Texas, J. O. Allen (*Texas Dept. Agr. Bul., n. ser., No. 20, pp. 13*).—According to the author's plan, the 50 acres are to be distributed as follows: Ten acres in corn

and peas, 10 acres in cotton, 5 in oats, 2 in peanuts, 4 in hay meadow, 2 in orchard and peas, 6 in pasture for cows and horses, 4 in pasture for hogs, and 1 acre each in stock beets, garden and truck, Irish potatoes, sweet potatoes, strawberries, Sudan grass, and Ribbon sugar cane.

Instructions are given as to how to prepare the soil for the crops mentioned, how to seed, cultivate, and market the crops, and how to handle the pasture, stock, and poultry.

California resources and possibilities (*Ann. Rpt. Cal. Develop. Bd., 26 (1915), pp. 64, pls. 2, figs. 5*).—This report continues data previously noted (E. S. R., 33, p. 894).

Tennessee: Facts about soil, climate, and rainfall (*Nashville, Tenn.: Dept. Agr., [1916], pp. 68, pl. 1, figs. 53*).—Detailed information is given concerning the soil, climate, rainfall, and production of crops and live stock in Tennessee.

[Agricultural statistics of British Guiana], E. S. CHRISTIANI (*Rpt. Dept. Sci. and Agr. Brit. Guiana, 1914–15, App. 6, pp. 18–22*).—This report contains data showing the area and production of the principal crops from 1905–6 to 1914–15 by counties and districts.

South African agriculture: An analysis, P. J. DU TOIT (*So. African Jour. Sci., 12 (1915), No. 5, pp. 145–155*).—In this analysis the author discusses the following factors affecting the agriculture of South Africa: Population, rainfall, transportation facilities, and types of agriculture based upon the principal products, such as sheep and wool and grain.

[Agriculture in New Zealand], M. FRASER (*Statis. Dominion New Zeal., 3 (1914), pp. 1–47*).—This continues data previously noted (E. S. R., 33, p. 193).

AGRICULTURAL EDUCATION.

Practical education—tomorrow's demand, L. W. SCOTT (*Manual Training and Vocational Ed., 17 (1916), No. 9, pp. 665–673*).—In this discussion the author attributes the shortcomings of our system of education largely to the failure of our schools to teach practical and utilizable knowledge. He concludes that the paramount issue of the school of to-morrow must not be preparation for college, but practical preparedness of every individual for life.

The effective use of the school farm: A record of an unfinished experiment, R. J. TEALL (*Manual Training and Vocational Ed., 17 (1916), No. 10, pp. 762–770, figs. 9*).—An account is given of the field work, together with an outline of the 4-year course of study at the Gardena Agricultural High School, which is a part of the Los Angeles, Cal., city system, and is located 14 miles from the center of the city. In the construction of the course and in the development of plans for the proper utilization of the school farm it has been clearly kept in mind that (1) a boy, especially a city boy, preparing for agriculture must devote several hours daily to productive manual work; (2) practice and theory, like induction and deduction, must go together; (3) the science teaching of the school must be correlated with the applied courses; and (4) any high school courses, even a vocational course, should be a broad one.

The school began agricultural work in 1910, has about 15 acres for agricultural use, and has 70 boys in the agricultural course, less than 20 of whom are country bred, and few of whom have ground available for home-project work. Six city boys, twelfth-year students, are given their board and lodging on the grounds, and in return do all the miscellaneous work of the farm before and after school hours. Each half year a new set of boys is chosen.

In the tenth and eleventh years field-practice courses are offered in which the boys do on the farm that particular piece of work which is most urgent,

whether in horticulture or animal husbandry, etc. Courses are offered in horticulture, agronomy, dairying, poultry keeping, and animal husbandry, largely text-book courses, but all related to the general course called field practice. The classes in farm building construction have erected a dairy building, a garage and wagon house, a small house for an acetylene gas generator, a blacksmith shop, and other small buildings, and with the assistance of two carpenters have constructed a good barn.

[Barrio school industrial efficiency contest], H. E. Cutler et al. (*Philippine Craftsman, 4 (1916), No. 7, pp. 429–496, figs. 29*).—A résumé of the barrio school industrial-efficiency contest is given, followed by discussions of standards by which industrial efficiency is judged, and an account of the work of the trade schools, farm schools, settlement farm schools, primary gardening work, etc.

The barrio schools reported instruction in gardening to classes ranging from 8 to 45 pupils. In 80 per cent of the schools 5 recitations were held per week, and more overtime was given to this course than to any other, and it was considered the one which most influenced the home. The average school garden contained 457 square meters (about 4,917 sq. ft.) of land with an animal-proof fence. The pupils cultivated on an average about 23 square meters of land at school and 16 square meters at home.

The present trend of nature-study in Wisconsin, F. T. Ullrich (*Nature-Study Rev., 12 (1916), No. 3, pp. 102–115*).—The author gives in detail the results of a questionnaire sent out as to the present trend of nature study in Wisconsin.

Systematic courses in nature study were presented in only 19 per cent of the 86 graded schools of the State reporting, but it was taught in an incidental manner in 24 per cent additional. The most frequent objections to or difficulties encountered in the presentation of systematic courses are overcrowded curriculum and dearth of qualified teachers for the instruction.

The majority of the replies state that the chief aims of nature study in the primary grades are to train the powers of observation, to develop the esthetic and appreciative capacities of pupils, and to acquaint them with the animate and inanimate material of their environment. The additional aims for the intermediate grades suggest special emphasis on training in the scientific method of thinking and the extension of the acquisition of information, and some educators think that a strong beginning should be made in the introduction of the economic elements into the instruction. In the grammar grades increased importance is given to the economic or vocational and the knowledge and preparatory aims.

The vocational aspect is presented in agriculture in three schools and in nature study in one. Even when agriculture is included with nature study the vocational in this subject is not very frequently attempted. There seems to be very little opposition to the idea of a vocational trend in nature study, although many believe that the cultivation of an appreciation of nature and nature's ways, may be defeated if the subject is over-practicalized.

The organization of nature-study, O. W. Caldwell (*Nature-Study Rev., 12 (1916), No. 5, pp. 189–192*).—Information from nearly 400 school systems in Indiana and Illinois, which were taken as types, shows that something like 80 per cent of these schools are now teaching nature study, some in all of the eight grades, and practically all in at least four years. Less definite information from most of the other States indicates an essentially favorable situation, while in a few States very little attention is given to the subject. The need of organized courses and principles of organization are discussed.

What shall be our policy concerning gardening in the elementary city schools? C. D. JARVIS (*Nature-Study Rev., 12 (1916), No. 4, pp. 174–178*).—Productive gardening is discussed as one of the best available means of training children in habits of thrift and industry, developing stronger bodied children, making it possible for them to remain in school longer and contribute to the support of the family, etc. A plan for conducting the work is outlined, and the conclusion is drawn that garden work is of great benefit in the training of children in towns and cities; that the work should be conducted on an intensive businesslike and profitable basis, to insure which qualified teachers should be provided and retained throughout the summer, for groups of children not exceeding 200; further, that the work should be made so attractive that it will not be necessary to offer prizes to maintain the interest of the children.

A graded course of garden work and nature-study, R. W. GUSS (*Nature-Study Rev., 12 (1916), No. 5, pp. 213–225*).—An outline is given of a course in garden work and nature study in the eight grammar grades and the first year of the high school in Cincinnati, in which an attempt is made so to grade the garden lessons and to correlate the nature study that each may help the other to educate the children through activities suited to their capacities and interests at different stages.

More than 500 children share the school garden of three acres near the school. In the first four grades the children have class or group plats, in the fifth and sixth individual plats, while in the seventh, eighth, and ninth grades the work is more optional and increasingly commercial or intensive (prevocational), larger areas being assigned to single applicants or to groups, usually for the growing of one crop. As a rule, these are pupils who have no land at home. Many of the children, however, have home gardens and the school gardens are used for learning gardening methods and as a laboratory for nature study and for growing nature study material. Much emphasis is laid upon summer supervision of both the school and the home plats.

Home gardens, G. B. GOLDSMITH (*Nature-Study Rev., 12 (1916), No. 1, pp. 22–26*).—The author discusses the value of home gardens for children, and suggests important considerations in flower and vegetable gardening.

Exercises in indoor gardening (for the use of schools), F. WATTS (*Imp. Dept. Agr. West Indies, Pamphlet 82 (1916), pp. [5]+48, pls. 10*).—In this pamphlet the commissioner of agriculture for the West Indies outlines a series of practical exercises which may be carried out indoors so that discipline may be easily maintained. They are to be used in connection with the text, Nature Teaching (E. S. R., 17, p. 603), and are preparatory to the more extended work of the school garden itself.

NOTES.

California University.—Dr. O. F. Burger, formerly assistant plant pathologist at the Florida Station, has been appointed instructor in plant pathology in the Graduate School of Tropical Agriculture at Riverside, and Alfred F. Swain assistant in entomology.

Kansas College and Station.—A country planning commission has been appointed by the state board of administration to meet the needs of rural communities. The board consists of eight specialists from the various state institutions, of whom five are from the college with Walter Burr, director of rural service work, as chairman.

Recent appointments include the following: Dr. M. C. Tanquary, assistant professor in entomology and assistant entomologist; R. K. Bonnett, assistant in farm crops; T. S. Townsley and F. E. Fox, assistants in poultry husbandry; A. E. Lawson, assistant in animal husbandry; D. H. Branson, animal husbandry assistant in extension schools; M. W. Kirkpatrick, superintendent of the Dodge City substation; Irwin T. Bode, foreman of the forest nursery at Hays; and Miss Dora M. Otto, research assistant to the director of the station. A. R. Losh, highway engineer in the extension division, has accepted a position with the office of Public Roads and Rural Engineering of the U. S. Department of Agriculture.

Nebraska University and Station.—The registration in the college of agriculture exceeds that of any previous year, taxing the accommodations in several departments.

Dr. A. R. Davis has been appointed assistant professor of agricultural botany, vice Miss Florence A. McCormick, resigned. E. L. Jenkins has been appointed instructor in animal husbandry.

Nevada Station.—Irrigation experiments have been particularly successful this year, owing to the fact that practically no rain fell during the entire summer, thus largely eliminating rainfall as a factor influencing the variations in yield.

Tests of anthrax serum, prepared by the method of Sobernheim, have shown the feasibility of making this serum by this method upon a commercial scale.

Cornell University and Station.—The faculty of the college of agriculture has been granted the privilege of electing two representatives to the state college council, with the right to vote. The council is an advisory body, reporting to the board of trustees, and the faculty has previously been represented thereon only by the dean. W. A. Stocking, jr., and J. G. Needham have been selected as the faculty representatives.

R. W. Rees, of the Massachusetts College, has been appointed extension professor of pomology; H. H. Knight, investigator in entomology; and C. B. Hutchinson, whose resignation from the Missouri University and Station has been previously noted, professor of plant breeding. Dr. Donald Reddick has been granted a year's leave of absence for special work in plant pathology at Johns Hopkins University.

Washington College.—D. S. Troy, of Chimacum, for 12 years a member of the board of regents and a prominent dairyman and Jersey breeder of the State, was killed August 18 in an automobile accident. J. P. Fairbanks, a 1916 graduate of the Nebraska University, has been appointed instructor in agricultural engineering.

Tenth National Dairy Show.—The first New England meeting of this show was held at Springfield, Mass., October 12–21, on the grounds of the Eastern States Agricultural and Industrial Exposition. All previous records for attendance, exhibits, and profits are said to have been broken. Nearly 1,000 entries of dairy stock were on exhibition and the attendance is estimated as averaging close to 30,000 per day.

Much prominence was given to educational features at the show. The U. S. Department of Agriculture gave special attention to its extension work among boys and girls, with several thousand exhibits of their work and many demonstrations by boys and girls illustrating methods in canning, bread making, dairying, selection of seed corn and potatoes, gardening, treatment of plant diseases, etc. A working dairy was also in operation by the Department.

The agricultural colleges of the vicinity cooperated in an eductional and agricultural display, each college concentrating its efforts mainly on some particular phase of the work. Thus Connecticut displayed a collection of forage crops, grasses, and root crops; Vermont depicted work in animal breeding; New Hampshire, farm management and accounts; Cornell, methods of teaching dairying; and Massachusetts, dairy manufactures and the care and handling of milk in the home.

The intercollegiate stock judging contest was participated in by eighteen institutions, many being represented for the first time. The highest rating for all breeds was attained by the University of Nebraska, with New Hampshire first on Ayrshires, Kansas on Guernseys, Massachusetts on Jerseys, and Nebraska on Holstein-Friesians.

There was also an intercollegiate butter-judging contest, arranged for the first time. In this contest, nine institutions were represented, first place being awarded to the Pennsylvania College.

Meetings of a large number of breed associations and other organizations interested in dairying were held during the show, that of the Official Dairy Instructors Association being noted below.

Official Dairy Instructors' Association.—This association met at Springfield, Mass., October 16–17, in connection with the National Dairy Show.

The presidential address was given by W. A. Stocking, jr., of Cornell University. Prof. Stocking emphasized, among other things, the need of higher standards and better preparation for men engaged in dairy work. Somewhat similar views were subsequently expressed at the annual banquet of the association by Dean C. E. Marshall of the Graduate School of the Massachusetts College, who urged that students be more broadly educated before being trained as specialists.

H. E. Rabild, of the Dairy Division of the U. S. Department of Agriculture, for the committee on methods of conducting student dairy cattle judging contests, gave a review of these contests showing the post graduate work and subsequent occupation of the successful contestants. The association voted to allow students who have participated in not more than one interstate judging contest to be eligible for the students' national contest, and to eliminate secondary schools from the contests except that, where there is no representation from the agricultural college of a State, students with certain qualifications from secondary schools directly under the supervision of the college may be admitted.

In a report as chairman of the committee on students' dairy products judging contests, W. P. Lockwood of the Massachusetts College stated that nine colleges and universities sent butter-judging teams to the first contest, held in connection with the Dairy Show. After a debate as to whether milk and cheese should be included in these contests, the committee was empowered to include as many products in next year's contest as it deemed wise.

A statistical review of milk and cream regulations was given by I. C. Weld, of Washington, D. C. The committee on legal limits for fat in ice cream was instructed to continue the work along the same lines. The committee on cream grading, to which one member was added from the Dairy Division, was directed to work out definitions for two or three grades of cream.

H. C. Troy of Cornell University gave a report for the committee on official methods of testing butter for fat, in which he described two proposed modified Babcock methods and gave results obtained by these methods in comparison with those obtained by the official chemical method. This report was referred back to the committee for further study.

H. H. Wing of Cornell University, for the committee on relations to breed associations, presented a report on official cow testing. Subsequently members of the association held a conference on the subject of this report with officials of the Ayrshire, Guernsey, Holstein-Friesian, and Jersey breed associations. After discussion the association voted (1) that the title of the person in charge of official cow testing in each State be the superintendent of official testing; (2) that the rules adopted by this association be published in pamphlet form and distributed to dairy testers; (3) that the different breed associations be asked to recognize the rules and regulations of the association in reference to official testing and to include them in their rules and regulations; (4) that the records of cow-testing associations be authenticated only when the official in charge of testing in the association is selected and appointed by the superintendent of official testing, and that this authentication of records shall be discontinued as promptly as some more satisfactory method shall be found; and (5) that the different breed associations be asked to recognize only one superintendent of official testing in each State.

C. Larsen, of South Dakota, for the committee on feeding standards for milk production, discussed the different standards, the methods used by experiment stations and farmers for comparing the value of different feeding stuffs, and the use of the feed unit system. The committee recommended that no system be adopted by the association until present investigations on nutrition by the different stations are completed.

The executive committee was empowered to appoint members of the association to be members of a joint committee from this association, the International Milk Inspectors' Association, and the Association of Milk Dealers on the matter of uniformity of inspection regulations by federal, state, and municipal authorities. Steps were also taken to revive the committee of the International Dairy Federation originally appointed by Major Alvord about 1895 with a view to creating a sentiment for getting the International Dairy Congress to meet in the United States. The executive committee was empowered to arrange for the publication of an official journal.

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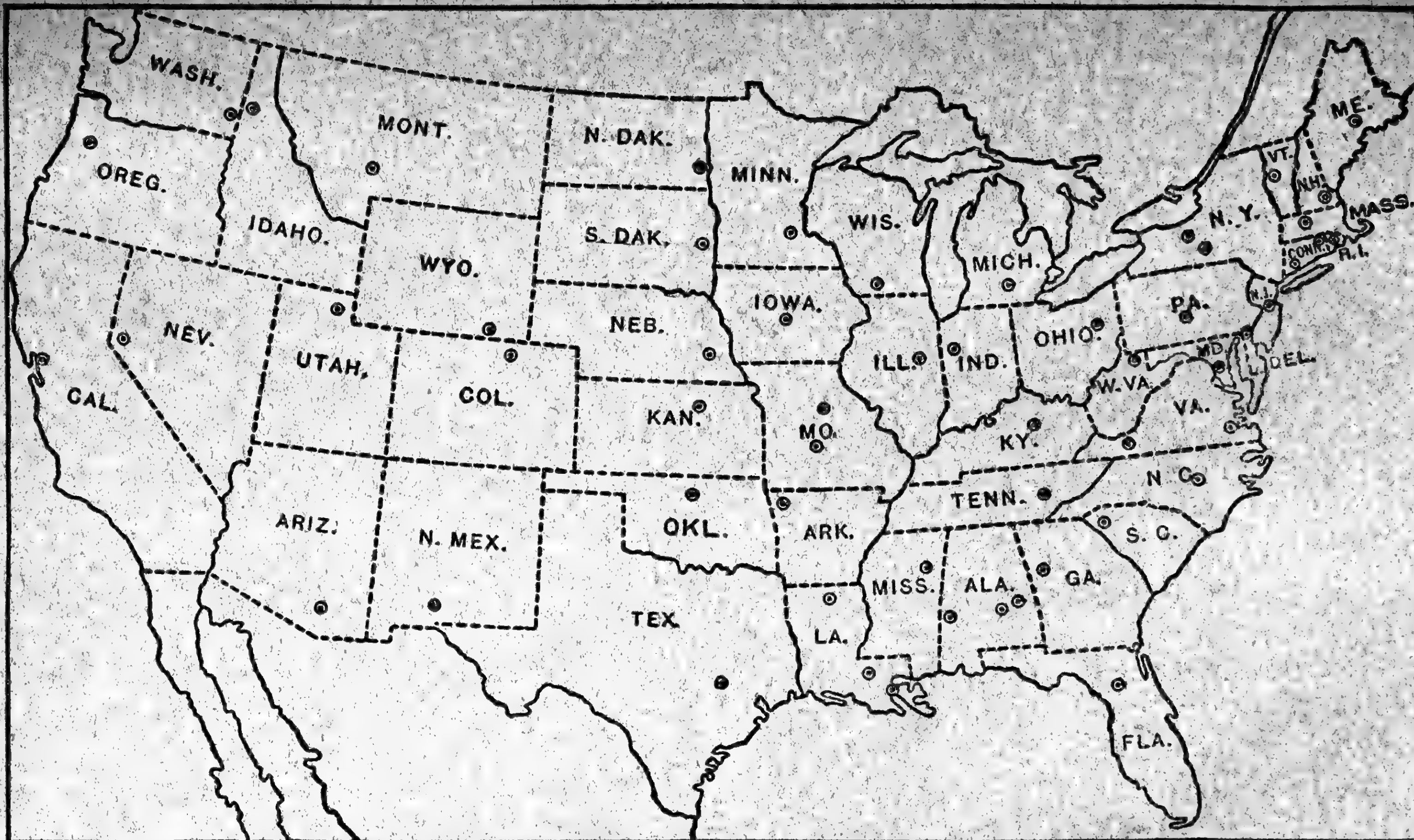
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LIST OF EXPERIMENT STATIONS AND DEPARTMENT PUBLICATIONS REVIEWED.

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U. S. Department of Agriculture—Contd.

[a] Printed in scientific and technical publications outside the department.

EXPERIMENT STATION RECORD.

VOL. 35. ABSTRACT NUMBER. No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Catalysis and its industrial applications, E. JOBLING (*London: J. & A. Churchill, 1916, pp. VIII+120, figs. 12*).—The subject matter of this volume appeared originally in the *Chemical World* in 1912. The topics discussed are catalysis in general; sulphuric acid manufacture; industrial chlorin, salt cake, and sulphur recovery; fixation of atmospheric nitrogen; surface action; hydrogenation; dehydrogenation and oxidation; and dehydration, hydrolysis, etc.

Hydrogen electrode potentials of phthalate, phosphate, and borate buffer mixtures, W. M. CLARK and H. A. LUBS (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 479–510, figs. 2*).—The authors have studied the hydrogen electrode potentials of the following mixtures at 20° C.: Acid potassium phthalate—hydrochloric acid; acid potassium phthalate—sodium hydroxid; acid potassium phosphate—sodium hydroxid; boric acid+potassium chlorid—sodium hydroxid; boric acid—sodium hydroxid; and potassium chlorid at 25°—hydrochloric acid. The concentration of the first component was in all cases maintained at 5/100-molar strength.

It is suggested that "a temperature correction should be included in the barometric correction of hydrogen electrode potentials. The application of this, together with a consideration of several theoretical and experimental difficulties, leads to the conclusion that in biochemical work the tenth-normal KCl-calomel electrode should be given the provisional and somewhat arbitrary value 0.3385 between 18 and 30° when referred to the potential of the 'normal hydrogen electrode.' By applying the full barometric correction and the above value of the tenth-normal calomel electrode the P_H values of the various mixtures were calculated, and the compositions given which furnish mixtures differing by intervals of $0.2P_H$ for use as comparison solutions in the colorimetric determination of hydrogen ion concentrations."

The system of "buffer" mixtures described has been shown to be simpler to prepare and easier to standardize than those now in common use. "Acid potassium phthalate solutions possess properties which make them comparable with or better than 'standard acetate' and similar solutions for standardizing hydrogen electrode systems."

A new "hot-air" Teclu burner, P. VERBEEK (*Chem. Ztg., 39 (1915), No. 148–149, p. 948, figs. 5*).—A new laboratory burner in which the admitted air is heated before it is allowed to mix with the gas and in which the width of the flame can be easily controlled by a simple arrangement is described in detail. An economy in both heat and gas is claimed for the improved burner.

The action of nitric acid on aluminum, R. SELIGMAN and P. WILLIAMS (*Jour. Soc. Chem. Indus., 35 (1916), No. 12, pp. 665–672, figs. 3*).—From a study of the action of nitric acid on aluminum the most important condition found to affect the rate of dissolution of the metal was the temperature of the acid. An increase of 10° C. over a considerable range of temperature was found sufficient to increase the rate of dissolution 100 per cent.

Next to temperature the concentration played the most prominent part in determining the rate of solution. Mixtures containing between 20 and 40 per cent by volume of nitric acid (specific gravity 1.42) were found to be the most active, while some samples containing as high as 94.7 per cent nitric acid were found to be almost without effect on the metal. A sample of aluminum suspended in such acid for 71 days lost only 0.0004 gm., equivalent to a rate of dissolution of 0.015 mg. per 100 sq. cm. per 24 hours.

Contrary to the statements of earlier investigators, the presence of 0.05 per cent chlorin in the acid was found not to affect the rate of solution. The same condition was found to prevail in the case of iodin up to concentrations of 0.01 per cent. Traces of sulphuric acid and the presence of the lower oxids of nitrogen, however, increased the rate of solution markedly. The action of the acid on the metal could be considerably reduced by freeing it from such oxids.

The effect of the physical state of the metal was considerable, the amorphous form being attacked much more readily than the crystalline. The composition of the metal was found to be of lesser importance, the pure metal, however, being generally found to be the most resistant to the attack of the acid. No local action or "pitting" was observed.

The apparatus and experimental methods used in the study are described in detail.

Sanitary studies of baking powders (*Biochem. Bul., 5 (1916), No. 20–21, pp. 158–202*).—The following studies on suitable analytical methods for the determination of small amounts of aluminum are reported.

II. *A comparison of the method proposed by the Association of Official Agricultural Chemists as modified by Steel with that described by Schmidt and Hoagland for the determination of aluminum in organic material,* P. E. Howe (pp. 158–164).—From experimental data reported it is concluded that, when compared to the results obtained with the procedure recommended by Schmidt and Hoagland,[a] for small amounts of aluminum in the presence of iron and phosphates the method proposed by the Association of Official Agricultural Chemists as modified by Steel in an article previously noted (E. S. R., 25, p. 573) yields values which are essentially the same in the case of pure aluminum salts, but slightly lower when applied to blood to which aluminum sulphate has been added.

III. *A study of the methods for the quantitative determination of aluminum in blood,* L. J. Curtman and P. Gross (pp. 165–172).—The authors have found the method of Steel to be unreliable, due to the instability of ferric phosphate. For the determination of small quantities of the metal in the presence of large amounts of iron the method is unsatisfactory. The procedure of Schmidt and Hoagland yielded accurate results both in pure solution of aluminum salts and in blood.

It is indicated that the procedure of Schmidt and Hoagland is superior to that of Steel from the standpoint of techuique for the following reasons: "(1) A direct gravimetric determination of aluminum is effected. No volumetric solution or operations are required and the aluminum is not found by difference (thus taking the sum of the errors). (2) The determination is made on the

[a] Jour. Biol. Chem., 11 (1912), No. 4, pp. 387–391.

entire sample, not on an aliquot portion of the solution as in Steel's method and, as a consequence, the error in dealing with small amounts is thus materially decreased. (3) The tedium of washing the precipitates is to a great extent avoided without any sacrifice of accuracy."

IV. *The determination of aluminum in the presence of iron and organic matter*, M. Steel (pp. 173–182).—The author concludes that his method yields accurate results for aluminum when care is taken in its manipulation. "The method proposed by the U. S. Government Committee on Research and Analytical Methods[a] is very similar to the method used by Steel. This method yields accurate results for aluminum, both in aqueous solution and in the presence of large amounts of organic matter. The Schmidt and Hoagland method is as accurate as the other two methods, and has the advantage . . . of involving fewer manipulations."

V. *The determniation of aluminum in biological material: A comparison of the method of Steel (modified by Kahn) with the method of Schmidt and Hoagland*, C. A. Smith and P. B. Hawk (pp. 183–188).—The method of Schmidt and Hoagland was found by the authors to be more satisfactory than the method of Steel as modified by Kahn in work previously noted (E. S. R., 27, p. 268) for the determination of aluminum in blood and in gastric juice to which known amounts of aluminum had been added. In determining the metal in gastric juice by the Schmidt and Hoagland procedure it is indicated that the material should be ashed before the determination is made.

VI. *Comment on the data in the preceding papers (II–V) on the best available method for the quantitative determination of aluminum in biological materials*, W. J. Gies (pp. 189–194).—From a critical examination of the data presented in the previous articles the author concludes that "the Schmidt-Hoagland method is somewhat more accurate and serviceable than the Steel method for the estimation of aluminum in biological materials, and that the Steel method gives low results." Further comments on the work (reported in the previous papers) by the various authors are included.

VII. *A direct test of the degree of accuracy of the Schmidt-Hoagland method for the quantitative determination of aluminum*, A. K. Balls (pp. 195–202).—Experimental data submitted show that "the Schmidt-Hoagland method for the determination of aluminum gave results which involved a loss of as much as 7 per cent of the available aluminum, but which was usually about 4 per cent. The losses appear to have been due, in the main, to the formation of Al_2O_3 from $AlPO_4$, in the precipitate of the latter during ignition, but also partly to the solubility of $AlPO_4$ in the reagents and washings. The material, as finally weighed, is not wholly normal orthophosphate of aluminum, but contains less phosphoric anhydrid than does the same weight of orthophosphate. The indicated error might invalidate the method for accurate determinations of relatively large amounts of aluminum. For comparatively small quantities, however, the error appears to be negligible."

See also the first paper of this series by Gies, noted on page 860.

The determination of bromin and iodin in the presence of chlorids, L. W. Winkler (*Ztschr. Angew. Chem., 28 (1915), Aufsatzteil, Nos. 96, pp. 477–480, figs. 2; 98, pp. 494–496, fig. 1*).—It is shown that by the use of potassium permanganate bromin can be accurately determined in the presence of chlorids. The procedure for the determination varies according to the amount of bromin present. For the accurate determination of very small amounts of bromin the free bromin extracted with carbon tetrachlorid is titrated with arsenious acid, using an aqueous iodin solution as indicator.

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[a] Jour. Indus. and Engin. Chem., 7 (1915), No. 5, p. 446.

For the determination of iodin a number of methods were tested.

The experimental procedures and data obtained are described in detail.

A new method for the volumetric determination of thiosulphate in the presence of sulphid and notes on the determination of thiosulphate in the presence of sulphite, bisulphite, and sulphid, A. SANDER (*Chem. Ztg., 39 (1915), No. 148–149, pp. 945–947*).—Three articles are presented.

I. *Thiosulphate in the presence of sulphid* (p. 945).—A new procedure based on the following equations, and which depends on titrating the hydrochloric acid formed, is described in detail:

$$3HgCl_2+2Na_2S=4NaCl+(2HgS.HgCl_2).$$
$$2Na_2S_2O_3+3HgCl_2+2H_2O=2Na_2SO_4+4HCl+(2HgS.HgCl_2).$$

The total thiosulphate+sulphid content is determined in an aliquot by titration with iodin. A second aliquot is treated with an excess of mercuric chlorid and well shaken until the dark precipitate becomes pure white. Ammonium chlorid is then added and the acid formed titrated with tenth-normal sodium hydroxid and methyl orange as an indicator.

II. *Thiosulphate in the presence of sulphite* (pp. 945, 946).—Earlier methods are briefly reviewed and criticized. The author obtained satisfactory results with the procedure of Bodnár (E. S. R., 31, p. 15), but indicates that it requires too much time for routine work. The determination of total sulphite+thiosulphate by titration with iodin in an aliquot and the titration of the hydrochloric acid formed after treatment with mercuric chlorid in another aliquot is recommended as an accurate and rapid procedure.

III. *Thiosulphate in the presence of sulphid and sulphite* (pp. 946, 947).—Previous work is briefly reviewed and the following procedure outlined:

From 10 to 20 cc. of the sample for analysis is poured into a measured volume of tenth-normal iodin which has previously been acidified with from 5 to 10 cc. of tenth-normal hydrochloric acid, the excess iodin is titrated with tenth-normal thiosulphate, and the total sulphid+sulphite+thiosulphate (a) thus determined. In the same solution the iodin used by the sulphite is determined by titrating the hydrochloric acid formed with standard alkali (b), using methyl orange as indicator, due allowance being made for the hydrochloric acid previously added. Another portion of the sample is poured into an excess of mercuric chlorid, thoroughly shaken until the dark precipitate first formed becomes pure white, ammonium chlorid added, and the hydrochloric acid formed titrated with tenth-normal sodium hydroxid, using methyl orange. The reactions taking place are those noted above for the sulphid and thiosulphate and the following for the sulphite:

$$Na_2SO_3+HgCl_2=NaCl+ClHg.SO_3Na.$$

In the thiosulphate reaction two molecular equivalents of hydrochloric acid are liberated by one molecular equivalent of thiosulphate, so that twice the volume of alkali (c) will be necessary for neutralization, as iodin was used in the first titration for thiosulphate. The various components are calculated from data as follows: Iodin used for thiosulphate$=\frac{c}{2}$; for sulphite, b; and for sulphid, $a-(b+\frac{c}{2})$. It is indicated that a determination can be made in 10 minutes and that the method is applicable in the presence of carbonate. In this case, however, a further titration with standard acid and methyl orange is necessary. Comparative experimental data demonstrating the accuracy of the method are submitted.

Determination of the hardness of natural waters, and the use of methyl red as an indicator, S. A. KAY and SUSAN H. NEWLANDS (*Jour. Soc. Chem. Indus., 35 (1916), No. 8, pp. 445–447*).—Modified procedures for the determination of both temporary and permanent hardness in water are described in detail. It is indicated that the proposed methods are more accurate than those now in common use.

Determination of calcium and magnesium in natural waters, S. A. KAY and SUSAN H. NEWLANDS (*Jour. Soc. Chem. Indus., 35 (1916), No. 8, pp. 447–449*).—On the basis of certain preliminary experiments the authors have devised a method for the determination of calcium and magnesium by (1) determining the total hardness of the water, and (2) determining the hardness due to calcium salts by evaporating the water with ammonium carbonate and extracting the residue with ammonium carbonate solution, which dissolves the magnesium carbonate, but is practically without action on the calcium carbonate. The amount of the latter is then ascertained by titration, and the magnesium is determined by difference.

Analytical data obtained from mixtures of known composition indicate the accuracy of the method.

Salicylic acid in wine, X. ROCQUES (*Ann. Chim. Analyt., 21 (1916), No. 6, pp. 117, 118*).—The author observed that in certain natural wines some interfering substance which masked the color of the delicate ferric chlorid test for salicylic acid was present. This was later found to be tannin.

To obviate this possible source of error the following procedure is described: To 20 cc. of wine in a 250-cc. flask 0.5 cc. of sulphuric acid and, after thoroughly mixing, 15 cc. benzin are added. The flask is then stoppered and without agitation let stand until the next day. The salicylic acid is thus extracted by the solvent and, on separating the benzin layer in a separatory funnel, can be easily detected by the ferric chlorid test. This procedure will detect as small an amount as 4 mg. of salicylic acid per liter of wine very clearly.

The direct determination of sucrose in the presence of reducing sugars, M. A. SCHNELLER (*Louisiana Stas. Bul. 156 (1916), pp. 12*).—Experiments are described from which the conclusions previously noted (E. S. R., 35, p. 316) are drawn.

A comparison of the results obtained by the colorimetric and gravimetric determinations of cholesterol, J. H. MUELLER (*Jour. Biol. Chem., 25 (1916), No. 3, pp. 549–560*).—From a critical study of the two procedures for the determination of cholesterol it is concluded that either method is accurate when applied to solutions of pure cholesterol. The ether extraction with dried blood, even when prolonged, was shown not to be complete. Hot alcohol or alcohol and ether must be used. "Colorimetric analyses of blood give results too high for true cholesterol, because they include other ether- and chloroform-soluble substances, whereas digitonin determinations are more nearly correct."

A rapid method for the separation of butter fat from nonfatty material, S. KORPÁCZY (*Ztschr. Untersuch. Nahr. u. Genussmtl., 30 (1915), No. 1, p. 24*).—The usual method for preparing pure butter fat was found by the author to consume too much time and to be subject to certain sources of contamination. For the rapid preparation of pure butter fat the following procedure is recommended:

Forty gm. of butter and 10 gm. of pure, finely powdered calcined gypsum are thoroughly mixed in a porcelain dish. This homogeneous mass is allowed to stand for 10 minutes and is then placed in a drying oven where it is allowed to melt slowly, after which it is rapidly filtered through a dry filter. It is indi-

cated that by this procedure from 20 to 22 gm. of pure butter fat can be prepared in an hour.

The determination of the specific gravities of fixed oils in the Tropics, C. H. WRIGHT (*Jour. Soc. Chem. Indus., 35 (1916), No. 8, pp. 457, 458*).—Due to the fact that the dew-point of the air is usually about 15.5° C. (59.9° F.), it is a difficult matter to determine the specific gravity at this temperature in the Tropics, since moisture condenses on the outside of the apparatus used. A Westphal balance can be used if the oil is cooled to 15.5°, but the procedure is not convenient on account of moisture condensation on the surface of the oil and the platinum wire attached to the plummet. A convenient and rapid method in which the specific gravity is determined at the temperature of the air and then calculated for specific gravity at 15.5° is outlined in detail and the calculations for the same explained.

Peanut oil, H. C. THOMPSON and H. S. BAILEY (*U. S. Dept. Agr., Farmers' Bul. 751 (1916), pp. 16*).—This is intended primarily for those interested in the manufacture of peanut oil or the growing of peanuts. It contains information regarding the manufacture of peanut oil in Europe and in this country, with reference to the preparation of the peanuts, the machinery used in peanut-oil manufacture, the by-products of the industry, and the economic aspects of the problems, such as yield, cost of production, and returns. Analyses showing the oil content of 12 samples of Spanish and 19 of Virginia varieties of peanuts, all grown in this country, and proximate analyses of the shelled nuts and shells of five varieties grown at Florence, S. C., are included.

Analyses of two oil fruits and seeds from tropical Africa, H. WAGNER and J. B. LAMPART (*Ztschr. Untersuch. Nahr. u. Genussmtl., 30 (1915), No. 6, pp. 221–226, figs. 2*).—The fruit of the plant *Coula edulis* is uniformly round and covered with an integument 5 cm. thick. The seeds themselves are white, with a very thin and brittle brown integument. The average weight of 100 nuts was found to be 1.463 kg. The sound seeds showed 12.01 per cent of protein, 30.48 per cent of fat, and 49.9 per cent of nitrogen-free extract.

The fat obtained was a brown liquid at room temperature and possessed no characteristic odor or taste. On analysis the following constants were obtained: Specific gravity (25° C.), 0.9116; index of refraction (40°), 51.2; acid value, 18.41; acid degree, 32.87; saponification value, 189.7; iodin value (Hübl), 83.36; Reichert-Meissl value, 0.36; and Polenske value, 0.22. For the total fatty acids the following values were obtained: Neutralization value, 197.5; average molecular weight, 284; iodin value, 87.09; and refractive index, 39.4. The phytosterol content was also determined according to the digitonin procedure and found to be 0.1623 per cent. The melting point of the acetate was from 128 to 129° and the solidifying point, 122.5°. On saponification a pure alcohol of melting point 135° was obtained.

The fruit of *Limonia warneckei* on analysis showed moisture, 7.26 per cent; protein, 16.26; fat, 38.5; fiber, 6.75; nitrogen-free extract, 25.72; and ash, 5.51 (0.85 per cent P_2O_5). The following physical and chemical constants of the oil were established: Refractive index, 47.7; melting point, 32.4°; solidifying point, from 21.5 to 21°; acid value, 4.13; acid index, 7.34; saponification value, 188.8; iodin value, 75.2; Reichert-Meissl value, 0.55; and Polenske value, 0.55.

For the total fatty acids the following constants were obtained: Refractive index, 38.3; melting point, 44.3°; solidifying point, 38.5°; neutralization value, 199.7; average molecular weight, 280.9; and iodin value, 80.47. The free and fatty acids were found to consist largely of palmitic acid. The phytosterol

obtained by digitonin precipitation after three crystallizations showed a melting point of from 123.5 to 124°, the acetate melting at from 138 to 138.5°.

The chemistry of the volatile oil of Achillea millefolium, E. R. Miller (*Bul. Univ. Wis., No. 785 (1916), pp. 33*).—In the investigation the author has obtained a blue oil from the leaves and flower heads of *A. millefolium.* Most of the oil is obtained from the flower heads, but very small amounts may be gotten from young plants. Drying the plant material produced no change in either the quantity or quality of oil. The oil was shown to contain *l-α*-pinene, *d-α*-pinene, *l*-limonene, *l*-borneol, bornyl acetate and other esters of borneol, *l*-camphor, cineol, salicylic acid, aldehydes, formic acid, acetic acid, butyric acid (?), iso-valeric acid, at least one nonvolatile acid or lactone, and a blue constituent of high boiling point.

Note on the economic uses of rosha grass (Cymbopogon martini), R. S. Pearson (*Indian Forest Rec., 5 (1916), No. 7, pp. 50, pls. 5*).—This publication is divided into the following sections: Description, distribution, and mode of growth of rosha grass; method of distillation, yield, and analyses of oil; uses; production; export trade; sales of the grass and oil; and conclusions arrived at and proposals made with a view to improving the rosha-oil industry. A Note on the Constants of Indian Geranium Oil (Motia), by Puran Singh (pp. 46–50) is appended.

Saw palmetto: A phytochemical study of the fruit of Sabal serrulata, C. A. Mann (*Bul. Univ. Wis., No. 767 (1915), pp. 60, pl. 1*).—This bulletin reports the results of a thorough study of saw palmetto. The subject matter is considered under the heads of synonomy, natural history, the material, the chemistry of saw palmetto, moisture, inorganic constituents and ash, the so-called volatile oil, fatty oil, enzyms, carbohydrates, glucosid, alkaloid, and conclusions. A bibliography is also appended.

Muscadine grape sirup, C. Dearing (*U. S. Dept. Agr., Farmers' Bul. 758 (1916), pp. 11, figs. 6*).—This describes in detail the preparation of a sirup from Muscadine grapes which is considered as good as or better than other sirups usually found on the table.

The process requires only simple and inexpensive equipment which is readily available. The method consists essentially of harvesting the fruit and extracting the juice, boiling with calcium carbonate to reduce the acidity, clarifying the juice by allowing the precipitated acids to settle, boiling down the juice to a sirup of the desired thickness, usually to about one-ninth of the volume of the original clarified juice used, and canning or bottling the sirup. The varieties of grapes having the highest natural sugar and lowest acid content are recommended as making the most delicious and highest quality sirup, and also as giving the greatest yield. It is indicated that these varieties yield over 3 gal. of fresh juice per bushel of grapes and, on condensing, approximately 1⅓ qt. of sirup.

Canning without sugar, J. S. Caldwell (*Washington Sta. Popular Bul. 103 (1916), pp. 4*).—This bulletin briefly describes the cold-pack method and the open-kettle method, and gives some notes on canning with the use of sugar and canning in tin.

The technology of sugar, J. G. M'Intosh (*London: Scott, Greenwood & Son, 1916, 3. ed., rev. and enl., pp. XV+526, figs. 244*).—This is the third edition of the work previously noted (E. S. R., 15, p. 933). It is divided into the following sections: Beet sugar; cane sugar; sugar refining; and the chemistry of sugars and analysis of commercial sugars and of merchandise, etc., containing sugars.

METEOROLOGY.

Weather forecasting in the United States (*U. S. Dept. Agr., Weather Bur. Doc. 583* (*1916*), *pp. 370, pls. 41, figs. 48*).—This is a handbook or manual dedesigned especially for "the officials of the Weather Bureau for their guidance in qualifying themselves in the art of forecasting." It is the joint work of a board consisting of A. J. Henry (chairman), E. H. Bowie, H. J. Cox, and H. C. Frankenfield, appointed for the purpose, but embodies contributions from various Weather Bureau officials especially experienced in actual forecasting. The various chapters and contributors are as follows: Introductory Note—General Principles and Theories of Atmospheric Motions, by C. F. Marvin; General Circulation of the Atmosphere, by W. J. Humphreys; Weather Forecasting—Preliminary Statement, by A. J. Henry; Auxiliary Pressure-change Charts, by A. J. Henry; Lows and Highs—General Considerations, by A. J. Henry; Cold Waves, by H. J. Cox et al.; Frost Warnings, by H. J. Cox et al.; Forecasting High Winds, by E. H. Bowie et al.; Heavy Snow, Sleet, and Ice Storms, Fog, by H. C. Frankenfield, and Thunderstorms, by A. J. Henry; Weather and Temperature Forecasts, Washington District, by A. J. Henry; Forecasting the Weather and Temperature, Chicago District, by H. J. Cox; Forecasting Weather and Temperature, New Orleans, Denver, Portland (Oreg.), and San Francisco Districts, by I. M. Cline, F. H. Brandenburg, E. A. Beals, and G. H. Willson, respectively; and Long Range Weather Forecasts, by E. H. Bowie.

As regards the book as a whole the chairman of the board says: "The book will be a disappointment to those, if there be such, who have formed the expectation that it will solve the difficulties of the forecasting problem. The consensus of opinion seems to be that the only road to successful forecasting lies in the patient and consistent study of the daily weather maps. Wherein the book will be helpful, however, is in the fact that it gives the experience of those who have gone before, and it is in this sense that it will find its most useful application."

A selection of books and papers, in English, on weather forecasting by Miss Eleanor Buynitsky is included.

Principles of study of the weather, G. Lfuboslavskiĭ (*Osnovaniia Ucheniia o Pogodie. Petrograd, 1915, 2. ed., pp. VII+412, pls. 4, figs. 187*).—This is a general treatise on meteorology, consisting of a revision and amplification of a series of lectures by the author at the Imperial Institute of Forestry. Following an introductory chapter on meterology in general, there are seven chapters on various phases of the statics of the atmosphere, four on the dynamics of the atmosphere, and two on weather and climate.

Tables for computing the time of moonrise and moonset, H. H. Kimball (*U. S. Dept. Agr., Weather Bur. Doc. 580* (*1916*), *pp. 29*).—"These tables have been prepared in response to repeated demands for a simple means of determining the time of moonrise and moonset at Weather Bureau stations. They are adapted from more extensive manuscript tables, furnished by the U. S. Nautical Almanac Office, for computing the time of moonrise and moonset at any place in the United States."

Fall frosts (*U. S. Dept. Agr., Nat. Weather and Crop Bul. 24* (*1916*), *p. 3*).—"The average date of the beginning of corn harvest in the extreme northern section of the United States is between September 1 and 15, or only slightly earlier than the average date of the first killing frost. In the northern part of the so-called corn States the average date of the first fall frost is between September 25 and October 1, and in the southern part of this region about October 20. A killing frost has been recorded in most of the central and

northern parts of the country from 15 to 30 days earlier than the average date, but a thorough study of all the available data shows that the probability of a killing frost occurring earlier than 10 days before the average date is only about one in ten.

"In the northern part of the cotton region the average date of the first fall frost is between October 20 and October 25, and in the southern part of the area the average date is about one month later. A killing frost has occurred in the northern part of the area as early as October 1 and in the southern part as early as November 10. The same rule applies, however, in this section of the country as in the Northern States, that the probability of a frost occurring earlier than 10 days before the average killing date is only about one in ten."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 3 (1916), Nos. 7, pp. 236, pls. 2, figs. 8; 8, pp. 224, pls. 2, figs. 4*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1916, respectively.

[The climate of Pavlovsk], A. V. SHIPCHINSKIĬ (A. SHIPCHINSKI) (*Zap. Selsk. Khoz. Inst. Imp. Petra I (Mem. Inst. Agron. Emp. Pierre I), 1 (1916), pp. 52–69*).—This is a summary of ten years' observations (1897–1904 and 1911–1913). The average annual temperature was 6.9° C. (44.4° F.); the precipitation, 500.3 mm. (19.7 in.). The prevailing wind was southeast.

SOILS—FERTILIZERS.

The loess soils of the Nebraska portion of the transition region.—III, Potash, soda, and phosphoric acid, F. J. ALWAY and R. M. ISHAM (*Soil Sci., 1 (1916), No. 4, pp. 299–316, figs. 2*).—This is a third report of studies conducted at the Nebraska Experiment Station (E. S. R., 35, p. 510).

It was found that "the total potash is very uniform in distribution both from east to west and from the first to the sixth foot. While, on the whole, it is slightly lower in the eastern areas and in the higher levels, the variations are small and irregular. The proportion soluble in hot, strong hydrochloric acid seems largely dependent upon the amount of silt present, it being lowest in the most westerly area, in which, while the total potash is highest, the proportion of very fine sand also reaches its maximum.

"The total soda shows somewhat more variation. In the western four areas it is quite uniformly distributed, both from area to area and from the surface downward, amounting, in general, to a little more than half as much as the total potash. In the two eastern areas it is distinctly lower; less is found in the upper than in the lower 3 ft., and in general it amounts to a little less than half as much as the total potash. The proportion of soda soluble in strong hydrochloric acid is lower than in the case of potash and is quite uniform.

"The total phosphoric acid is still less evenly distributed. In the first 2 ft. it seems much the same from east to west, while in the two eastern areas it is higher in amount in the lower than in the upper sections. Most of it is soluble in strong hydrochloric acid, neither location nor depth seeming to influence in the proportion. . . .

"Determinations were made of the total potash, soda, and phosphoric acid, as well as of the portions of these soluble in cold 1 per cent hydrochloric acid, in four separates—clay, silt, very fine sand, and coarser particles—from typical humid and semiarid subsoils. In the very fine sand from the humid subsoil the amount of potash was found to be about the same as in the clay, but distinctly lower than in the silt. In the semiarid subsoil it was similar in the silt and very fine sand, in both of which it was only very slightly higher than

in the silt from the humid area, but was somewhat lower in the clay. In both subsoils the amount of soda was highest in the very fine sand and much the lowest in the clay. The dilute acid dissolved about four times as much potash, but only about half as much soda, from the semiarid as from the humid subsoil, but the soluble portions of both form only a small proportion of the total amounts present. On the other hand, the dilute acid removed from both more than half the total phosphoric acid, the proportion dissolved being higher in the semiarid subsoil. In the separates much more phosphoric acid was found in the clay than in the silt and the very find sand, in which it was alike.

"The most noteworthy differences were shown by treatment with citric acid solution. The potash soluble in this reagent was found to increase with the aridity; in the most humid areas it decreases from the surface downward, while in the least humid it increases, notwithstanding an accompanying increase in the carbonate content . . . In contrast with this, the citric acid-soluble phosphoric acid was found not to increase with the aridity, when [considering] the whole 6-ft. section; in the first 2 ft. it increases, but in the lower 4 ft. it decreases from east to west. In the most humid areas it increases rapidly from the surface to a depth of 6 ft., while in the most westerly areas it decreases. In the latter the difference is to be attributed to the increase in carbonate content, because when this is neutralized the sixth foot yields as much to the acid as does the first. The high content of citric acid-soluble phosphoric acid is not confined to the lower portion of the 6-ft. sections, but continues to more than twice this depth. . . . In content of potash, soda, and phosphoric acid the soils from all the areas resemble the chernozem soils of Russia and the arid soils of California."

A list of 12 references to literature bearing on the subject is appended.

The loess soils of the Nebraska portion of the transition region.—IV, Mechanical composition and inorganic constituents, F. J. Alway and C. O. Rost (*Soil Sci., 1 (1916), No. 5, pp. 405–436, figs. 2*).—It was found that "the loess soils of the Nebraska portion of the transition region consist chiefly of very fine sand and silt which together constitute from 77 to 95 per cent of the soil mass, the remainder being chiefly clay. From east to west the clay decreases and the relative proportions of the silt and the very fine sand change, the former decreasing and the latter increasing. The mechanical composition shows no distinct relation to the depth except that the clay content is lower in the first than in the second foot. . . .

"The samples were subjected to both a complete rock analysis and to 5-day digestion with hydrochloric acid of 1.115 specific gravity. The carbon dioxid, which is present chiefly in calcium carbonate, shows greater variations than any other constituent; while low in the first 2 ft. of all the areas, the amount in the subsoil increases markedly from east to west. The lime varies widely, both the total and the acid-soluble portion, being three times as high in the western subsoils as in the eastern. The content of magnesia shows no definite relation to that of the lime, in the eastern areas it being as high but in the western much lower; it is independent of the aridity and, except that it is lowest in the surface foot, also of the depth. The total alumina is very uniformly distributed but in all the areas shows a minimum in the surface foot. The acid-soluble portion is similar in the western four areas, but markedly higher in the eastern two; like the total it is lower in the first than in the second foot. It shows no definite relation to either the clay or the acid-soluble potash. The iron, manganese, and titanium are distinctly higher in the eastern two than in the other four areas. Almost the whole of the iron is acid-soluble; like the alumina it shows a minimum in the surface foot. The whole of the manganese

is acid-soluble, but only a small part of the titanium. The silica is very uniformly distributed but, in contrast to the alumina, is in each area slightly higher in the first than in the second foot. Sulphur and baryta show no dependence upon either depth or aridity. About half of the former is acid-soluble, but none of the latter. To litmus the samples are all neutral or very slightly alkaline. The acid-insoluble matter shows no definite relation to the aridity and, except that it is higher in the first than in the second foot, none to the depth. The proportion of acid-insoluble material in the nonvolatile, carbonate-free portion of the soil is highest in the surface foot and similar in the lower levels, as though leaching had affected the silicates of only the first foot.

"In mechanical compositions these loess soils show the same characteristics as the Russian chernozem. Also, in the chemical composition of the inorganic portion, both the total and the acid-soluble, in so far as the available data permit of comparisons, there is a very marked similarity.

"A comparison with the average composition of arid and humid soils shows that, except in the proportions of manganese, the first foot samples of the loess soils from the most humid areas studied resemble the arid soils as much as do those from the distinctly semiarid western areas. In the case of this one constituent the soils from the eastern areas resemble those from the humid regions reported by Hilgard. In carbonate content the subsoils from the western and intermediate areas resemble arid subsoils and those from the eastern areas the humid soils."

A list of 15 references to literature bearing on the subject is appended.

Soil survey of Laurens County, Georgia, A. T. Sweet, G. B. Jones, E. T. Maxon, T. M. Morrison, and E. C. Hall (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 41, fig. 1, map 1*).—This survey, made in cooperation with the Georgia State College of Agriculture and issued September 12, 1916, deals with the soils of an area of 509,440 acres in the higher Coastal Plain in central Georgia.

"The topography ranges from undulating or rolling, or even broken in places in the northern part of the county and near the large streams, to almost flat in sections of the southern part. . . . The soils of the county are derived from the unconsolidated sediments of the Coastal Plain. They are prevailingly sandy in the surface portion and have sandy clay subsoils." Including swamp, 17 soil types of 13 series are mapped, of which the Norfolk sandy loam and the Grady sandy loam cover 33.4 and 11.1 per cent of the area, respectively.

Analyses of soil types of Troup County, W. A. Worsham, Jr., L. M. Carter, D. D. Long, and M. W. Lowry (*Bul. Ga. State Col. Agr., No. 92 (1915), pp. 28, figs. 2*).—This bulletin reports general soil survey data for the county and gives the results of chemical analyses of samples of all the types mapped, together with suggestions for utilizing the potential fertility of the soils.

Soil survey of Dekalb County, Missouri, H. H. Krusekopf, R. C. Doneghue, and M. M. McCool (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1914, pp. 25, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station and issued September 9, 1916, deals with the soils of an area of 266,880 acres in the gently rolling prairie region of northwestern Missouri, the topography of which varies from level to rolling. Regional drainage is well developed. The soils of the county are of glacial, loessial, and alluvial origin. Seven soil types of 5 series are mapped, of which the Shelby loam and the Grundy silt loam cover 54.4 and 24.9 per cent of the area, respectively.

Soil survey of Wayne County, North Carolina, B. B. Derrick, S. O. Perkins, and F. N. McDowell (*U. S. Dept. Agr., Advance Sheets Field Operations Bur. Soils, 1915, pp. 51, fig. 1, map 1*).—This survey, made in cooperation with

the North Carolina Department of Agriculture and issued August 31, 1916, deals with the soils of a fairly well-drained area of 354,560 acres in east-central North Carolina, the topography of which includes broad, gently rolling inter-stream areas, which become more rolling as the larger streams are approached. The county lies wholly within the Costal Plain soil province.

"The soils of Wayne County are derived from the unconsolidated sands, clays, and gravel of sedimentary origin." They include both upland and bottom land types. Including swamp, 23 soil types of 11 series are mapped, of which the Norfolk fine sandy loam, sandy loam, and sand cover 22.4, 21.4, and 13.4 per cent of the area, respectively.

Study of an exact classification of soils with reference to climate and geology, R. Lang (*Internat. Mitt. Bodenk., 5 (1915), No. 4, pp. 312–346, fig. 1*).—The work of others bearing on the subject is briefly reviewed, and a study of soil classification is reported in which, first, the influence of the main climatic factors in soil formation, such as temperature and humidity, and the remaining soil forming factors are dealt with. Finally, the changes produced are described by which the development of soils under special climatic conditions can take place.

It is concluded that the rain factor, computed from the average annual rainfall and the average temperature, is very important in determining the limits of the extent and conditions of the formation of a soil type.

Use of the moisture equivalent for the indirect determination of the hygroscopic coefficient, F. J. Alway and J. C. Russel (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 22, pp. 833–846*).—In this contribution from the Minnesota Experiment Station, experiments with silt loam soils collected from 30 virgin prairie fields in Nebraska are reported, the purpose of which was to determine the reliability of the use of the moisture equivalent for the indirect determination of the hygroscopic coefficient in soils.

It was found that "the hygroscopic coefficient may in most cases be calculated from the moisture equivalent with sufficient accuracy to permit its use in soil-moisture studies. For certain types of soil, however, the ratio departs so widely from that assigned by Briggs and Shantz (E. S. R., 26, p. 628) that the indiscriminate use of the latter value does not seem permissible. Before employing this indirect method for the determination of the hygroscopic coefficient in connection with soil-moisture studies the ratio should be experimentally established for each of the particular types of soil involved.

"The effect of considerable quantities of organic matter is, in general, to give the ratio of the moisture equivalent to the hygroscopic coefficient a higher value. In the case of any extensive study of soil moisture involving many soil types, the same general conclusions as to the relation of the nonavailable moisture to the hygroscopic coefficient are to be expected, no matter whether the latter value be directly determined or be calculated from the moisture equivalent by the Briggs-Shantz formula. For the calculation of the moisture equivalent from the mechanical analysis no general formula appears universally applicable, the formula needing modification according to the soil type to which it is to be applied."

Soil tank investigations, S. E. Collison (*Florida Sta. Rpt. 1915, pp. CII–CV*).—A continuation of the investigation on the losses of fertilizing constituents in the drainage water from soil (E. S. R., 33, p. 24) is reported.

"The loss of nitrogen has increased somewhat over that for last year. The loss of potash has increased in two of the tanks and decreased slightly in the other two. . . . The loss of nitrogen was very large in the earlier periods but has decreased notably in the later ones, reaching the lowest figure in 1914, and increasing somewhat for 1915. . . . The losses of potash have increased from

the beginning to the present date with two of the tanks, while with the other two the highest point was reached in 1914. . . . The losses of lime and sulphate are still increasing."

Water table variations, causes and effects, A. B. Ballantyne (*Utah Sta. Bul. 144 (1916), pp. 23, figs. 16*).—This bulletin reports the results of 1,111 measurements, by means of wells, of the water level variations in a soil described in a previous report by Widtsoe and Stewart (E. S. R., 29, p. 18), the purpose being to show the effect of rainfall and irrigation water at different seasons and the influence of the water level variations on soil and vegetation.

It was found that the level of the free soil water was lowered by natural drainage, surface evaporation, and growing vegetation. "The normal precipitation caused it to rise, the amount depending upon the distance of the free water from the surface and the quantity of rain falling, small amounts showing no appreciable influence." Long continued irrigations caused the water level to rise, the rise being greatest where the free soil water was nearest the surface, but apparently depending upon the length of time the stream was allowed to run on the land. "The fluctuation of the water level caused by heavy applications of water followed by long dry periods . . . caused the death of large numbers of trees and vines; the first of the former which died were those where the water was confined to two or four narrow furrows . . . made close to the trees. The ones that were alive to the last were on those parts flooded by the regular irrigations. It lessened the lucern field's production to less than one-fifth of its former normal yield. Crops of oats grown after the lucern at no time produced more than half crops. The application of less water more rapidly applied is indicated as the logical remedy for this seeped condition."

The relation between absorption and coagulation and its importance in soil, A. de Dominicis (*Staz. Sper. Agr. Ital., 48 (1915), No. 8, pp. 525–555; abs. in Chem. Zentbl., 1915, II, No. 26, p. 1307; Jour. Chem. Soc. [London], 110 (1916), No. 641, I, p. 240*).—Experiments with clay are reported which led to the following conclusions:

The phenomena of absorption and coagulation proceed together, and a change in one is always accompanied by a simultaneous, analogous change in the other. For instance, the coagulating powers of different ions correspond with their degrees of absorption. Absorption effects a retrogression of the colloids, a diminution of the difference of electrical potential between the contrasted phases, and a rise in the surface tension, the phenomenon of coagulation thus making its appearance.

Soil colloids, P. Rohland (*Landw. Vers. Stat., 88 (1916), No. 1–2, pp. 121–129*).—A further discussion is given dealing mainly with the adsorptive powers of clay, lateritic, and red soils (E. S. R., 32, p. 318).

Bacteriological studies of a soil subjected to different systems of cropping for twenty-five years, P. L. Gainey and W. M. Gibbs (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 24, pp. 953–975, fig. 1*).—Studies conducted at the Missouri Experiment Station of the bacterial numbers and ammonia and nitrate-forming powers of a silt loam soil, part of which has been in continuous culture to specific crops and part subjected to varying fertility treatment for 25 years, are reported.

It was found that the soil under continuous corn and wheat contained, in the absence of any additions of fertilizers or manure, relatively low numbers of bacteria. In the presence of manure, continuous corn and wheat soils contained relatively high numbers, manure having a much more marked effect upon numbers here than under the other crops studied. No appreciable effect upon the ability of the soil to liberate ammonia from cotton-seed meal was

obtained, but the ability to oxidize ammonia nitrogen to nitrate nitrogen was materially altered. Continuous corn and wheat with no additions of manure or chemicals brought about a relatively low oxidizing power in the soil complex. The addition of manure, and to a less extent commercial fertilizers, materially raised the oxidizing power, especially under continuous corn and wheat.

The nutrition of soil bacteria, E. R. Allen (*Mo. Bul. Ohio Sta., 1 (1916), No. 8, pp. 249, 250*).—Experiments with extracts from a fertile soil before and after the soil was ignited are reported, which show "that soil is superior to sand for the support of nitrification and that the addition of humus improves the sand while the addition of carbon black does not. Both humus and carbon black remove substances from solution by absorption, but the actions of the two . . . have been quite different. Ignition of soil, which would destroy its humus, helped rather than injured its power to support nitrification. The addition of humus to ignited soil exerted but little effect upon nitrification. The experiments, however, do not confirm or disprove either the physical or chemical theory."

Influence of barnyard manure and water upon the bacterial activities of the soil, J. E. Greaves and E. G. Carter (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 23, pp. 889–926, figs. 10*).—Experiments conducted at the Utah Experiment Station are reported, dealing with (1) the bacterial activities of a soil receiving a definite amount of manure and measured quantities of irrigation water and kept fallow in pots under vegetation house conditions, (2) the bacterial activities in a fallow soil under field conditions receiving known quantities of manure and water, and (3) the bacterial activities of soil treated as in (2) but producing a crop. The soil used was of sedimentary nature and consisted of fine sand and coarse silt of fairly uniform physical and chemical composition to a great depth.

It was found that in a calcareous soil kept in pots for four months "the temperature of the manured and unmanured averaged practically the same for the period, but the temperature of the soil with 12.5 per cent of water averaged 1° C. higher than did soils with 22.5 per cent of water. The greatest number of organisms developed on synthetic media from the soils receiving the greatest quantity, 25 tons, of manure. There were more colonies developed from the soil receiving 12.5 per cent of water than from any of the other soils receiving higher quantities of water.

"The ammonifying powers of the soil increased with the manure applied up to 25 tons of manure per acre, but the greatest increase per ton of manure was obtained in soil receiving 5 tons. The ammonifying powers of the soils increased as the water applied increased until 20 per cent of water was applied. The ammonifying powers of soil receiving 22.5 per cent of water were not as high as were those of soil receiving 20 per cent of water. The greatest increase per unit of water applied was when the water was increased from 12.5 to 15 per cent of water.

"The nitrifying powers of the soil increased as the manure and water applied increased up to 25 tons of manure and 22.5 per cent of water.

"The nitrogen-fixing powers of the soil were greatest in those pots receiving 10 tons of manure per acre. Increasing the water above 12.5 per cent but not above 22.5 per cent slightly increased the nitrogen-fixing powers of the soil. Nothing in the results indicated that the application of manure up to 25 tons per acre and of water up to 22.5 per cent caused denitrification in the soil.

"Bacteriological analyses of fallow field soil receiving none, 5 tons, and 15 tons of manure per acre and receiving none, 5 in., 10 in., 20 in., 30 in., and 40 in. of irrigation water gave the following results:

"The maximum number of bacteria were obtained from the soil receiving 15 tons of manure. The application of irrigation water up to 20 in. increased the bacterial count, being most noticeable in the soil receiving the greatest quantity of manure. If the ammonifying powers of the unmanured soils are considered as 100 per cent and the unirrigated as 100 per cent, the manured and irrigated soils then become with 5 tons of manure, 147 per cent; with 15 tons of manure, 188 per cent; 5 in. of water, 106 per cent; 10 in. of water, 117 per cent; 20 in. of water, 108 per cent; 30 in. of water, 106 per cent; and 40 in. of water, 108 per cent. Large quantities of irrigation water produced the greatest depressing effect in the presence of 15 tons of manure per acre. The application of manure to a soil increases its nitrifying powers. The application of irrigation water to a fallow soil apparently depresses its nitrifying powers. Fewer organisms develop on synthetic agar from a cropped than from a fallow soil. The application of manure to a cropped soil increases the bacterial count of the soil. The greatest number of organisms developed from the soil receiving 10 in. of irrigation water.

"The ammonifying powers of the cropped soils were slightly lower than similarly treated fallow soils. The application of 5 and 15 tons of manure per acre to a soil increases the ammonifying powers of the soil. The application of irrigation water up to 30 in. increases the ammonifying powers of the soil. The greatest increase resulted in those soils receiving 15 tons per acre of manure. The application of 40 in. of irrigation water to corn land, especially to that receiving 15 tons of manure per acre, depresses the ammonifying powers of the soil.

"The nitrifying powers of fallow soil were higher than similarly treated cropped soils. The application of manure to a cropped soil greatly increases its nitrifying power. The application of irrigation water up to 30 in., especially to a soil receiving 15 tons of manure per acre, greatly increases its nitrifying powers.

"There was found to be a direct relationship between the bacterial count, the ammonifying powers, the nitrifying powers, and the crop produced on a soil receiving no manure, 5 tons, and 15 tons of manure per acre. A close correlation was also found to exist between the bacterial activities of soil receiving varying amounts of water and the crop produced upon the soil."

A list of 52 references to literature bearing on the subject is appended.

The value of manure as compared with chemical fertilizers, C. E. Thorne (*Mo. Bul. Ohio Sta., 1 (1916), No. 8, pp. 253, 254*).—A review of experimental work at the staton shows that "open-yard manure of good quality should not cost more than about $2 a ton and manure fresh from the stable not more than $2.50 a ton, spread on the field, as compared with nitrate of soda at $60 a ton, 16 per cent acid phosphate at $18, and muriate of potash at $50 properly compounded and spread on the field." On the other hand it is pointed out that 100 tons of manure produced annually from well-fed animals and used in a systematic rotation of crops and supplemented with acid phosphate, bone meal, or raw rock phosphate may be expected to produce as large an increase in crops as an annual expenditure of $200 to $250 in chemical fertilizers.

The decomposition of the organic matter of kelp in the soil, A. W. Christie (*Jour. Indus. and Engin. Chem., 8 (1918), No. 5, pp. 425–427; abs. in Chem. Abs., 10 (1916), No. 11, p. 1571*).—Experiments conducted at the California Experiment Station on the extent and rate of decomposition of kelp in fine sandy loam soil as compared with manure, straw, and alfalfa are reported. The two samples of kelp used were *Macrocystis pyrifera* and *Nereocystis leutkeana*. It was found that "dried and ground kelp decomposes in the soil under laboratory

conditions, increasing the humus content to an extent comparable with alfalfa, manure, and straw. Of the pentosans present, 75 to 80 per cent was decomposed in all the materials."

The solvent action of ammonium salts on phosphorites in sand cultures, F. V. Chirikov (T. Tschirikuw) (*Iz Rezul't. Veget. Opytov. Lab. Rabot* (*Rec. Trav. Lab. Agron.*), *9* (*1913*), *pp. 436–440*).—This is a continuation of the experiments with sand cultures conducted in 1912 (E. S. R., 29, p. 624). In addition to calcium carbonate, magnesium carbonate was also used in 1913 to secure neutralization of ammonium salts, both being taken in quantities equivalent to one-half or all of the sulphuric acid in ammonium sulphate. The phosphorite was Russian, containing 25.86 per cent of phosphoric acid.

The results of the experiments with barley were fully concordant with those obtained the previous year. No decrease in the yield resulted from neutralization of the acid with calcium carbonate, but the yield declined when magnesium carbonate was used in place of calcium carbonate. In the experiments with buckwheat the yields were lower when calcium nitrate was replaced by ammonium sulphate.

Relation of calcium carbonate to the soil phosphates and acid phosphate, J. L. Burgess (*Bul. N. C. Dept. Agr.*, *37* (*1916*), *No. 5, pp. 16*).—This is a brief popular discussion of the subject based largely on work at the different state experiment stations.

The influence of lime on the yield and nitrogen content of corn, A. W. Blair and H. C. McLean (*Soil Sci.*, *1* (*1916*), *No. 5, pp. 489–504, figs. 3*).—In experiments at the New Jersey Experiment Station on a medium loam soil with a series of 20 twentieth-acre plats arranged for a study of nitrogen availability, an application of ground limestone at the rate of 2 tons per acre increased the yield of shelled corn by about 10 bu. and of stover by 432 lbs. per acre, as compared with the yield from a similar series of unlimed plants.

"The influence of the lime on the yield from the plat which annually received its nitrogen in the form of ammonium sulphate, as compared with the yield from the similarly treated plat, unlimed, was especially marked. The liming likewise resulted in greatly increased yields on certain of the plats which received their nitrogen in the form of rather slowly available organic materials, as, for example, wheat or rye straw. It also resulted in decided increases in the yields on plats which received minerals only, indicating that in the soil of these plats there was a considerable store of inert nitrogenous material which required only a favorable soil reaction to make it available. Unlimed plats which received an extra heavy application of manure, or manure and nitrate of soda, gave yields fairly approaching or even surpassing the yields given by plats which received similar nitrogenous treatment and lime. That is, the manure or the basic materials in the manure and nitrate of soda apparently decreased the need for lime. The average percentage of nitrogen in the grain and stover from the limed plats was slightly greater than the average in the grain and stover from the unlimed plats. The average recovery of nitrogen from the limed plats was 36.2 per cent and the average from the unlimed plats was 25 per cent."

A list of 18 references to literature bearing on the subject is appended.

Effect on plant growth of sodium salts in the soil, F. B. Headley, E. W. Curtis, and C. S. Scofield (*U. S. Dept. Agr., Jour. Agr. Research*, *6* (*1916*), *No. 22, pp. 857–869, figs. 8*).—Pot experiments with wheat on sandy loam, loam, and beach sand to determine the influence of the carbonate, bicarbonate, chlorid, and sulphate of sodium when added in amounts varying from nothing to sufficient to prevent plant growth entirely are reported.

It was found that "only a part of the salt added to the soil in pot cultures could later be recovered from it by water digestion. This apparent loss of salt . . . was greater in the case of sodium carbonate and sodium sulphate than with sodium chlorid.

"Where sodium carbonate was added to a soil the absorption was greater in fine soil, rich in organic matter, than in sand. The limit of tolerance of crop plants to the salt in the soil is determined by the quantity of salt that can be recovered from the soil rather than by the quantity added to the soil. The carbonates and bicarbonates of sodium are mutually interchangeable in the soil, and the toxicity of the soil solution appears to depend upon the quantity of the basic radical held in the soil regardless of the form of the acid radical. . . . The proportion of recoverable salt which would reduce by one-half the growth of wheat seedlings was for the carbonates 0.04 per cent of the dry weight of the soil, for the chlorids 0.16 per cent, and for the sulphates 0.35 per cent. The proportion of recoverable salt which prevented germination of wheat was for the carbonates 0.13 per cent, for the chlorids 0.52 per cent, and for the sulphates 0.56 per cent."

The toxic action of soluble aluminum salts upon the growth of the rice plant, K. Miyake (*Jour. Biol. Chem., 25 (1916), No. 1, pp. 23–28; abs. in Jour. Soc. Chem. Indus., 35 (1916), No. 12, p. 700; Chem. Abs., 10 (1916), No. 14, p. 1902*).—Experiments conducted at the University of California are reported in which rice seedlings were grown in solutions of aluminum chlorid and hydrochloric acid of concentrations varying from 1/1,000 normal to 1/20,000 normal.

It was found that aluminum chlorid was toxic to the growth of rice seedlings, even in dilute solution, the toxic effect appearing in concentrations greater than 1/7,500 normal. "The toxicity of aluminum chlorid seems to be approximately equal to that of hydrochloric acid of the same normality, [and] is not due to the hydrogen ion formed by hydrolysis of the salt in solution. The concentration of hydrogen ions formed by the hydrolysis of aluminum chlorid is less than that formed by dissociation of hydrochloric acid of the same normality. Since the chlorin ion is not toxic to the growth of rice seedlings in such dilute solution, colloidal aluminum hydroxid or unhydrolyzed aluminum chlorid molecules or aluminum ions may be the toxic factors. The toxicity of soluble aluminum salts is dependent upon the amount of aluminum itself.

"The determination of soil acidity by titration in which the soil extract is titrated with standard alkali is a logical method of determining the amount of bases which should be added to the soil for the amelioration of its infertility; because, although the titration does not indicate the true acidity of the soil, yet it does afford a measure of the bases which must be added to neutralize the free acid and decompose the aluminum salts, either or both of which may be responsible for the infertility."

The agricultural value of greensand marl, A. W. Blair (*New Jersey Stas. Circ. 61 (1916), pp. 2–13, fig. 1*).—This circular includes a discussion of the agricultural value of greensand marl, and reports analyses of 42 samples collected in New Jersey showing that the phosphoric-acid content varied between 0.045 per cent and 2.31 per cent and the potash content between 1.03 per cent and 6.5 per cent.

The utilization of molasses as a manure, L. De Waal (*Internat. Sugar Jour., 18 (1916), No. 210, pp. 267–272*).—Fertilizer experiments with molasses in heavy clay and sandy cane soils are briefly reported.

The results are taken to indicate that "molasses constitutes a valuable rectifier for cane soils, which, when applied in combination with organic matter, has given marked results in estate experiments on a large scale during three consecutive years. Even in a diluted form the results were very encouraging.

AGRICULTURAL BOTANY.

Hybrids of the genus Epilobium, R. HOLDEN (*Amer. Nat., 50 (1916), No. 592, pp. 243–247, figs. 4*).—The author has extended the investigations of Jeffrey (E. S. R., 31, p. 823; 32, p. 521) on the relation of hybrid infertility to defective or abnormal development of the gametic elements. He now reports on some observations of two sections of the genus Epilobium, Chamænerion and Epilobium proper, the latter having typically regular flowers and spores persistent as tetrads, the former habitually showing considerable irregularity and even absence of protoplasm in some of the spores, a condition supposed to indicate impurity.

Investigation of North American forms agreed with the expectation as above noted, but English specimens showed abortive spores not only in *E. montanum*, *E. parviflorum*, and *E. hirsutum*, but also in *E. angustifolium*. This fact, at first apparently contrary to previous observations, appeared on further investigation to be due to the presence of two varieties of *E. angustifolium* in England, *E. macrocarpum* and *E. brachycarpum*, and to the fact that wherever these are found growing together cases of partially abortive spores are also found, indicating a hybrid origin of such plants. This state of affairs is said to exist not only in England but probably also in Europe, Asia, and western North America, where both varieties are known to coexist; while the spores are all normal in localities where but one variety exists. Chamænerion is therefore regarded as affording confirmation instead of refutation of the value of abortive pollen grains as a test of hybridization.

The genetic behavior of the hybrid Primula kewensis and its allies, CAROLINE PELLEW and FLORENCE M. DURHAM (*Jour. Genetics, 5 (1916), No. 3, pp. 159–182, pls. 7*).—The authors have made a progress report on their study of the genetic behavior of *P. kewensis* (known to have originated in 1900 as a hybrid between *P. floribunda* and *P. verticillata*), its parents, numerous derivatives, and genetic combinations. The experiments consisted in breeding the various forms in large numbers and in making all cross-fertilizations possible among them. The results are given in considerable detail.

It is stated that from the cross *P. verticillata* by *P. floribunda* and the reciprocal, and, in fact, between any two forms, plants representing the female parent are usually obtained. The suggestion is considered as evident that this is a case of actual parthenogenesis or else of monolepsis (in which ovule development requires the stimulus of fertilization, but in which, however, the pollen grain really makes no genetic contribution to the final product). These maternal hybrids rarely show evidence of segregation when used for crossing and usually breed true to type on self-fertilization. It is stated that under most stringent tests positive evidence of true parthenogenesis has been obtained, but the evidence as a whole favors the theory that while the ovules can develop without fertilization they more commonly develop in consequence of that stimulus.

The offspring of the tetraploid *P. kewensis*, both on selfing and crossing, generally reproduced the female type simply, but a single diploid individual has been produced from this form. This has exhibited segregation of an almost normal kind and has given new forms representing combinations of *P. floribunda* and *P. verticillata*, the seeds of which generally germinate freely in contrast with those commonly obtained from *P. kewensis*. Among these new forms are many shades of yellow not previously known in these plants. The factorial relations are still under investigation. The diploid plant has been crossed with the tetraploid *P. kewensis*, the results being plants intermediate between *P. floribunda* and *P. kewensis* and a few resembling *P. floribunda*.

Mendelian inheritance in varietal crosses of Bryonia dioica, W. N. JONES and M. C. RAYNER (*Jour. Genetics, 5 (1916), No. 3, pp. 203–224, pls. 3, figs. 6*).—Results of breeding experiments on the genetical behavior of certain differentiating features in two strains or varieties of *B. dioica* are reported.

The author states that the absence of a waxy bloom on the ripe berries of one variety behaves as a simple dominant to the presence of a waxy bloom on the berries of the other variety, the presence and absence of bloom behaving as a pair of simple allelomorphic factors. The observed proportion of two-carpellary to three-carpellary flowers obtained by crossing the two varieties can be interpreted by assuming the cooperation of two factors. The numbers of vascular bundles in the stems of these two varieties are typically 10 (5+5) and 14 (7+7) respectively, the capacity to increase the number of bundles beyond 10 behaving as a simple dominant to absence of such capacity. Differences relating to habit and foliage are evidently complex in origin, requiring further study. It is regarded as determined that crossing leads to the production of new types in the second generation, that segregation occurs involving the reappearance of the original characters of the grandparents in the F_2 generation, and that the number of factors for leaf shape is probably not over two.

The experiments on Bryonia emphasize the need for caution in the subdivision of existing species without regard to breeding tests. It is thought that a number of segregates showing morphological differences due to new combinations can arise from the intercrossing of a few stable types within the limits of a so-called species. The stability of these new forms can be tested only by breeding, and the extreme types among them may be connected by an almost continuous series of transition forms.

Studies on size inheritance in Nicotiana, E. M. EAST (*Genetics, 1 (1916), No. 2, pp. 164–176, figs. 4*).—The results of a study of simple and obvious Mendelian phenomena, as noted in a cross between two varieties of *N. longiflora*, are reported.

The author states that the minimum number (not less than eight) of requirements, mostly independent mathematically, which should be met by pedigree culture data when all populations succeeding the original cross are obtained by self-fertilization, are met by data here presented or elsewhere observed, and that not one fact has been discovered to be directly opposed to them. Considering these data apart from other known facts, it is held that while the evidence tends to justify the use of the plural segregating factors in the interpretation of size inheritance, dogmatic conclusions should not be drawn from a single set of experiments. Numerous size studies by authors mentioned should be considered together in order to arrive at a reasonable judgment as to the mechanism by which such characters are transmitted.

Some notes on the Linaceæ. The cross pollination of flax, J. V. EYRE and G. SMITH (*Jour. Genetics, 5 (1916), No. 3, pp. 189–197*).—It is stated that while testing many species of Linaceæ for cyanophoric glucosids during the past three years, it was noted that those species having white, red, or blue flowers were more or less richly cyanophoric, whereas the yellow-flowered species, which usually show a different habit, failed to yield hydrogen cyanid and appeared to lack cyanogenetic enzym. Studies made during 1913 on a large number of both blue and yellow flowered species have confirmed observations previously reported (E. S. R., 28, p. 503).

In view of an expected early interruption of this study, a provisional report is made on the details of recent progress in work, which is still incomplete.

Note on experiments with flax at the John Innes Horticultural Institution, W. BATESON (*Jour. Genetics, 5 (1916), No. 3, pp. 199–201*).—The author reports

failure in attempts to cross the annual homostyled *Linum usitatissimum* with some such heterostyled species as *L. perenne*. He states, as a result of experimentation briefly noted, that the raising of a tall strain of flax is a very easy matter and can be done by selection of materials already existing in common crops. It is thought that most seed produced under natural conditions results from self-fertilization.

It is thought by the author that besides the oil flaxes, which are about 1.75 ft. in height, there are in England pure types of at least three other heights, the native tall strain measuring about 4 ft., several ordinary blue, and also some white, forms about 3 ft. high, and a dark blue true-breeding type about 2.5 ft. in height.

The ecological histology of prairie plants, Ella Shimek (*Proc. Iowa Acad. Sci., 22 (1915), pp. 121–126, pl. 1*).—The material for this investigation, which is here only partially reported but which is intended to ascertain the character of the various structural adaptations to environment made by ordinary plants in Iowa, includes 65 of the 271 species characteristic of the prairies. It is stated that the flora of the prairie is essentially xerophytic, differing from desert flora chiefly in the degree of modification for protective purposes. The xerophytic adaptations vary in different species as do the xerophytes of the desert, though usually in smaller degree.

On the behavior of an excised branch of the Sahuaro, R. J. Pool (*Plant World, 19 (1916), No. 1, pp. 17–22, fig. 1*).—A branch of the giant cactus (*Carnegiea gigantea*), having been removed from Tucson, Ariz., to Lincoln, Nebr., produced several flowers in 1914 and a much greater number in 1915, but no fruits were produced from any of these flowers. A second specimen treated in like manner produced neither flowers nor fruits in 1915.

On the association and possible identity of root-forming and geotropic substances or hormones in Bryophyllum calycinum, J. Loeb (*Science, n. ser., 44 (1916), No. 1128, pp. 210, 211*).—An account is given of recent experiments which led the author to conclude that the substances responsible for root formation in the stem of *B. calycinum* are associated or possibly identical with the substances causing geotropic curvatures of the stem of this plant. This close association or identity of organ-forming and geotropic substances, it is thought, might also explain the regeneration that takes place in certain coniferous trees when the uppermost horizontal branch begins to grow vertically if the apex is cut off.

Do fungi live and produce mycelium in the soil? S. A. Waksman (*Science, n. ser., 44 (1916), No. 1131, pp. 320–322*).—By a method of incubation for a comparatively short period, the author has found evidence indicating that a number of organisms form mycelium in the soil. About 15 species were found more or less commonly in soils of different types and from different localities, *Mucor circinelloides*, *Zygorhynchus vuilleminii*, a green Trichoderma, *Rhizopus nigricans*, and *M. racemosus* being found most abundantly. The Zygorhynchus was the only organism isolated at depths of from 12 to 30 in. A number of other organisms were only rarely found, which are quite usually found present by the dilution method of plating. Organisms such as species of Aspergillus, Alternaria, Cladosporium, and most species of Penicillium did not appear on the plates within 24 hours when the soil had been inoculated directly upon sterile medium.

The red color of the mesocarp of seeded fruits in the persimmon (Diospyros kaki). A visual method for estimating astringency, F. E. Lloyd (*Plant World, 19 (1916), No. 4, pp. 106–113, fig. 1*).—It is stated by the author that in persimmons of the race Zengi, studied by him, the region of nonastringency is not coextensive with that of the red colored tissues. From this it is inferred

that the red coloration is a consequence of the changes leading to nonastringency and is itself not the cause of that condition.

A visual method for accurately measuring astringency is given. It is based on the observation that the degree of astringency depends on the degree of adsorption of tannin by the X-cellulose (a carbohydrate of the nature of cellulose).

The theories of photosynthesis in the light of some new facts, H. A. SPOEHR (*Plant World, 19 (1916), No. 1, pp. 1–16*).—Following a review of the studies which have been concerned chiefly with the reduction of carbon dioxid to formaldyhyde, the detection of formaldehyde in illuminated green plants, and the experimental employment of formaldehyde as the sole source of carbon for plants, the author gives an account of experiments carried out by himself at Tucson, Ariz., where the days are largely clear and the light intense, a great number of experiments having been made with the object of reducing carbon dioxid by means of light from various sources.

It was found that neither when mixed with water vapor nor when dissolved in water did carbon dioxid, though exposed from 1 to 150 hours, ever yield conclusive tests for the presence of formaldehyde. Formic acid was the only reduction product obtained, which fact is considered as important. The author states that his studies on the action of gaseous formic acid on green plants in the light show that, although this compound is toxic to the roots, the chlorophyllous portions develop normally in an atmosphere of formic acid, show an appreciable gain in dry weight, and form starch.

It is stated that, although the same criteria which have been applied to the formaldehyde theory may be urged perhaps even more consistently in favor of a formic acid hypothesis, this fact still does not appear to the author to justify the formulation of a formic acid hypothesis.

A simple and rapid method of studying respiration by the detection of exceedingly minute quantities of carbon dioxid, A. R. HAAS (*Science, n. ser., 44 (1916), No. 1125, pp. 105–108*).—A description is given of a simple apparatus that may be used in determining the respiration of organisms, the amount of respiration being accurately observed by changes in the colors of indicators added to solutions which contain the organisms.

It is found that exceedingly small amounts of carbon dioxid may be determined with great accuracy. As changes in color often occur within a few minutes, it is claimed that the experiments may be so shortened as to exclude pathological changes in the organisms. As the amount of carbon dioxid can be determined without disturbing the organisms, a study of the dynamics of the method is made possible.

The controlling influence of carbon dioxid.—III, The retarding effect of carbon dioxid on respiration, F. KIDD (*Proc. Roy. Soc.* [*London*], *Ser. B, 89 (1916), No. B 612, pp. 136–156, figs. 3*).—Previous work (E. S. R., 32, p. 328) has led to the conclusion, among others, that the resting condition of moist seed often observable in nature is primarily a phase of autonarcosis under the influence of carbon dioxid produced by the seed itself (retardation and suspension of normal activity in plant protoplasm being produced by carbon dioxid in conditions otherwise favorable to growth and during a stage normally characterized by vigorous growth). The author has now extended these investigations to plant tissues in general in order to determine the mechanism of such narcosis. The influence of carbon dioxid upon respiration has been studied on account of its apparent connection with growth by cell division.

It has been found that carbon dioxid in plant tissues causes a depression of anaerobic carbon dioxid production. This depression is not due to permanent disorganization, as it is temporary and disappears with the disappearance

of its cause. It occurs under both anaerobic and aerobic conditions. Depression of aerobic respiration is shown when measured by either oxygen consumption or carbon dioxid production. Where oxygen is so scant that some carbon dioxid is produced anaerobically, carbon dioxid has no retarding effect on oxidation. A quantitative relation exists between carbon dioxid concentration and the depression of aeroble respiration as in anaerobic carbon dioxid production. It is held that of the two types of respiration demonstrated by Blackman and others (E. S. R., 26, p. 822), namely, floating respiration and protoplasmic respiration, it is the former only which is depressed by the retarding action of carbon dioxid.

The main conclusion to be drawn from these results as regards the inhibitory action of carbon dioxid upon growth is that a marked reduction of respiration is involved in the mechanism of carbon dioxid narcosis. It is considered that anaerobic and aerobic carbon dioxid production are processes genetically connected in normal respiration, and that the rate of the anaerobic process acts as the limiting factor in normal respiration.

Osmotic pressures in plants.—VI, On the composition of the sap in the conducting tracts of trees at different levels and at different seasons of the year, H. H. Dixon and W. R. G. Atkins (*Sci. Proc. Roy. Dublin Soc., n. ser., 15 (1916), No. 6, pp. 51–62, fig. 1*).—In a previous publication (E. S. R., 35, p. 26), the authors showed that sap centrifuged from the wood of trees always contained sugars and salts, the former predominating as a rule. In the present paper, an account is given of a study on the composition of the sap at different levels in the same tree and at different seasons of the year upon closely similar trees. Nine trees were used in the experiments, including 4 deciduous trees, 3 evergreens, and 2 sub-evergreens.

It was found that large quantities of sap may be centrifuged from the conducting wood of trees, and that the sap varies in color and in electrolyte and nonelectrolyte content. When in a condition of physiological rest during the late autumn and winter, the osmotic pressure of the wood sap of deciduous trees is small and practically constant. During the early spring the sap is enriched by the addition of large quantities of sugars from the storage cells of the wood parenchyma and the medullary rays, and the osmotic pressure rises in a very marked degree from root to summit. During the late spring, the concentration of sugars is still considerable, being roughly half of the earlier value. The electrolytes of the sap are, however, present in much greater concentration than in the early spring.

In *Acer macrophyllum*, reducing sugars are never found in the wood sap except in traces, while sucrose is present in quantity. In the other trees examined, both reducing sugars and sucrose were present, the latter predominating as a rule. During the vernal mobilization of reserves, the reducing sugars consist of hexoses and maltose. At other times, the latter is absent.

In evergreens and sub-evergreens the seasonal changes are not very striking nor are the gradients of osmotic pressures from root to summit so regular as in deciduous trees. The osmotic pressure of the transpiration sap in the root exceeds that in the stem at certain seasons.

Imbibitional swelling of plants and colloidal mixtures, D. T. MacDougal (*Science, n. ser., 44 (1916), No. 1136, pp. 502–505*).—Attention is called to the fact that the swelling of gelatin in distilled water, alkali, and acid has been used as a reference phenomenon in interpreting the water relations of plants, especially in growth. During the course of the studies of growth (which is considered to be largely dependent upon absorption and retention of water), disks of the flattened joints of an Opuntia were cut and so arranged as to show variations in swelling. It was found that both young and old tissues take up more

water when neutral or alkaline, and acidity, in addition to retarding enzymatic action presumably including respiration, operates to decrease imbibition by plant tissues.

Having found that plant cells show the greatest capacity for imbibition of water, not in acidified, but in alkaline solutions, the author has attempted to find substances or mixtures of substances that behave in a like manner. The effect of increasing percentages of agar in a gelatin mixture has been investigated, from which it appears that the mixture swells more in distilled water and less in acid or alkali. Concerning the relative effects of acid and alkali, definite conclusions have not been reached, but the data suggest that acid tends to increase imbibition at the ends of the series, while alkali tends to increase it in the mixtures containing the two colloids in more nearly equal proportions.

The penetration of balanced solutions and the theory of antagonism, W. J. V. Osterhout (*Science, n. ser., 44 (1916), No. 1133, pp. 395, 396*).—It is stated that antagonism has been explained by assuming that antagonistic substances prevent each other from entering the cell. A difficulty is said to be found in the fact that they slowly penetrate the cell even in a properly balanced solution. This difficulty, however, disappears if it is supposed that the antagonistic substances affect certain life processes which control permeability. So long as they are present in the right proportions their effect on these processes is favorable and their penetration into the cell can do no harm. The preservation of normal permeability is regarded as the result rather than the cause of antagonism.

Antagonism and Weber's law, W. J. V. Osterhout (*Science, n. ser., 44 (1916), No. 1131, pp. 318–320*).—The fact that Weber's law governs antagonism is explained by a dynamical theory formulated by the author. This theory assumes that injury and death result from processes which are inhibited by salt compounds formed by the union of salts with protoplasm. If these compounds are formed in a surface, the amounts will, above a certain limit, be independent of variations in concentration and will depend only on the proportions of the antagonistic salts.

FIELD CROPS.

Transpiration as a factor in crop production, T. A. Kiesselbach (*Nebraska Sta. Research Bul. 6 (1916), pp. 3–214, figs. 48*).—Part 1 of this bulletin is devoted to a discussion of work by earlier investigators in measuring the water loss through plants, the methods employed in the present study, and the factors influencing the results; part 2 to the description of the experiments and the presentation of the data secured; and part 3 to the application of the results in farm practice. The investigations were conducted to determine principles underlying the use of water by crops, and for this purpose plants were grown to the maturity at which they are usually harvested and under controlled conditions in pots, generally 16 by 36 in. in size, having a capacity of approximately 250 lbs. of moisture-free soil and sufficiently large to produce a normal plant. Means taken for the elimination of errors are discussed and 88 references to the literature cited are given.

Corn was grown to study the relation of environmental factors to the water requirement. Sunflowers and several sorghums were compared with corn, and a number of varieties differing in acclimatization and plant characters were compared with each other. The rain was excluded from the pots and evaporation from the soil surface was reduced to an almost negligible amount. Nearly all pots were situated in a corn field with their top level with the surrounding land, and the plants produced normal yields.

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The rate of water loss from a corn plant was found to be affected in a rather similar manner by changing climatic conditions as it was from a physical free water surface. The amount of water transpired from a given area of leaf expanse was determined as approximately one-third as great as the evaporation from a free water surface of the same area. The rates of transpiration and evaporation, following the same general sequence as the diurnal climatic factors, increased gradually from early morning, reached the maximum between 1 and 3 p. m., and gradually receded until late in the evening. Transpiration was reduced relatively more than evaporation during the night, suggested as due to the almost complete closing at night of the leaf stomata.

The daily variation in the water requirement was found to be very marked, the maximum observed in two successive days being 600 per cent. The data further showed that under extreme atmospheric conditions as high as 10 lbs. of water may be transpired by a single corn plant during 24 hours. Such days, it is pointed out, are very critical for corn when the soil moisture is insufficient to meet this demand. The weekly amount of water used gradually increased up to the development of the maximum leaf area, and for four or five weeks after this time the transpiration rate remained high, fully one-half of the total water used by the plant being transpired during this period. While a marked variation in the water requirement of different years was observed, there existed a rather consistent relationship in the relative seasonal variations between the transpiration per unit of dry matter, the transpiration per unit of leaf area, and the evaporation from a free water surface. As an average for three greenhouse tests conducted during two years a difference of 22 per cent in relative humidity and 1.7° F. during the day caused a difference of 42 per cent in the water requirement per pound of dry matter, 38 per cent in the transpiration from a unit of leaf area, and 46 per cent in the evaporation from a free water surface. Corn plants in greenhouses transferred from a humid atmosphere to a dry one and vice versa exhibited no difference in transpiration rate under the changed conditions as compared with each other.

A transpiring leaf was found to be uniformly cooler than a dead, dry one, amounting under extreme conditions to 8.6° in the sun and 4.2° in the shade at 2 p. m., when transpiration was maximum. The transpiring leaf as compared with the air at that time was 4.1° cooler in the sun and 3.2° cooler in the shade. Other data secured showed that vegetation is a great protection against excessive transpiration and also against evaporation from the soil surface.

A reduction in soil moisture content below the optimum during three years reduced the water requirement per pound of ear corn 4.3 per cent and per pound of total dry matter 7.9 per cent, but it also reduced the stalk yield by 37.3 per cent, the yield of ear corn by 28.5 per cent, and the yield of total dry matter by 30.7 per cent. An increase in the soil moisture content above the optimum during three years increased the water requirement per pound of ear corn 13.5 per cent and per pound of total dry matter 8.2 per cent, being accompanied by a reduction in stalk yield of 11.3 per cent, yield of ear corn of 21.1 per cent, and yield of total dry matter of 16.7 per cent.

The water requirement per pound of dry matter was found to be much larger in an infertile than a fertile soil. As an average for two years, equal applications of sheep manure to infertile, intermediate, and fertile soils reduced the water requirement for ear-corn production 42.6, 25.4, and 10.5 per cent, respectively; for total dry matter the reduction was 28.9, 17.1, and 8.1 per cent, respectively. On the other hand, the total water requirement per plant was increased, respectively, 106.7, 42.6, and 28.7 per cent. The reduction in water requirement per pound of dry matter is regarded as being more a matter of plant nutrition than of transpiration.

Varieties of corn grown continuously for many years under humid and under relatively dry conditions were found to have approximately the same average water requirement per pound of dry matter. The extreme variation in the water requirement of 11 varieties of corn differing in acclimatization and habits of growth was 230 lbs. and 296 lbs. per pound of dry matter, although most varieties were rather uniform in this regard. Several varieties with alleged special drought resistance possessed practically the same water requirements per pound of dry matter as the average of all the 11 varieties tested. The water requirement for milo maize was the same as the average for the 11 varieties, but for Black Amber sorghum it was considerably higher. Wild sunflowers exhibited a water requirement per pound of dry matter approximately double that of corn and a total water use somewhat greater than that of three corn plants.

In a study of the intake of soil solutes data were obtained concerning the relation between transpiration and ash content as affected by atmospheric humidity, seasonal climatic differences, soil fertility, soil moisture, kind of crop and variety, and limitation of the amount of soil through the size of the potometer. An increase in the greenhouse in atmospheric humidity, lowering the free water evaporation 47 per cent, reduced the amount of water transpired per gram of ash content 38 per cent and per gram of dry matter 40.5 per cent. A natural climatic difference, lowering the free water evaporation 40 per cent during July and August in 1913 as compared with 1914, reduced the transpiration per gram of ash content 22 per cent and per gram of dry matter 27 per cent. Under otherwise equal conditions the amount of water used per unit of dry matter fell, and the amount of solute taken in per unit of water transpired, as well as the amount taken into the plant, the dry matter produced, and the total amount of water transpired, rose with the availability of the soil solutes in different degrees of soil fertility. As compared with an abundance of moisture, less water was transpired per gram of ash content and also per gram of dry matter in a relatively low soil saturation. The influence of the size of the potometer was brought out by the fact that in potometers containing 32.5, 85, 150, 239, 583, and 956 lbs. of soil the amount of transpiration per gram of ash content was 6.14, 5.7, 5.2, 5.5, 5.07, and 4.32 kg., respectively. From a review of all the data the author believes it may be concluded that at least within the practical limits of crop production, other things being equal, an increase in the density of the soil solution is accompanied by an increase in the amount of solute taken into the plant per unit of water transpired.

Considerable variation was determined between the different varieties of corn and sorghum with reference to the thickness of the leaf and of the epidermis, and also in the number of stomata per unit of leaf area, but without an apparent striking or consistent correlation with the transpiration rate per unit of dry matter or per unit of leaf area of the different varieties, and also without striking response in the relative number of stomata to variation in either soil moisture or soil fertility. As an average for 11 varieties of corn, a plant having 949 sq. in. of leaf area had 104,057,850 leaf stomata, which occupied in the epidermis of both sides of the leaf, when open, 1.52 per cent of the area of the leaves. The entire epidermis comprised 30.8 per cent of the leaf thickness.

"Transpiration appears to be a purely physical phenomenon, depending primarily upon the moisture supply in the leaf and the evaporating power of the atmosphere, which is modified in some degree by temperature effects resultant within the leaf from chemical activity, transpiration, and from the absorption of radiant energy."

[Report on the progress of farm crops investigations] (*Missouri Sta. Bul. 141 (1916), pp. 29–31, 36–39, fig. 1*).—In wheat breeding investigations con-

ducted in 1914 by C. B. Hutchison and E. M. McDonald, 49 of 112 pure lines of wheat selected from 12 commercial varieties gave larger yields than the variety from which they were selected. Of 34 pure lines of Mediterranean 16 yielded 33.7 and 18, 23.5 bu. per acre as compared with 28.68 bu. for the commercial variety. In another test of 62 selections from hybrids compared with their parents and with pure lines selected from these parents, the pure lines in most cases gave the better yields.

Selections were also made of winter oats and winter wheat in connection with work carried on by C. B. Hutchison, E. M. McDonald, and A. R. Evans. Winter Turf and Culbertson winter oats came through the winter of 1913–14 in good condition, while Argentine Winter and Texas Red Rust Proof badly winter-killed. The varieties of winter barley under experiment were Tennessee Winter, Wisconsin Winter, Tenkan, and two-row Hybrid.

Studies of the adaptation of the important types, varieties, and regional strains of alfalfa to Missouri conditions and cultural experiments with soy beans were pursued by J. C. Hackleman. In 1914, when a severe drought reduced the yield of alfalfa, the largest total yield, 2.25 tons per acre, was secured from seed which came from Mongolia, and the next best yield was secured from seed of Minnesota Grimm. Good yields were also obtained from seed from France, Montana, and Bohemia. The yields from tests of different rates of seeding of soy beans were placed from best to poorest at 42, 104, 64, and 82 lbs. per acre. In trials with placing the rows different distances apart the largest yield of hay was secured with the distance of 40 in. between the rows, followed by rows seeded 8, 24, 16, and 32 in. apart, in the order named.

Sweet clover investigations were conducted by C. B. Hutchison, J. C. Hackleman, and A. R. Evans. A dry season interfered with the work. A wide variation in the percentage of hard seed in the samples sown was observed. Many samples germinated as low as 10 per cent, while sulphuric acid treatment increased the germination to as much as 60 per cent in some cases. The best stands were obtained by seeding alone between April 1 and June 1 and between August 15 and September 1.

A study of spring, summer, and fall grown crops for forage was made by J. C. Hackleman and A. R. Evans. The best combinations of fall-sown crops for winter pasture and spring forage were rye and vetch and rye and crimson clover. In the spring-sown series rape proved the best forage crop, both in growth and in drought resistance. In a summer-sown series harvested in October very little difference in weight of dry forage between sorghum and cowpeas and cowpeas and corn was observed. There was a larger percentage of peas in the corn than in the sorghum, although the seeding of peas was at the same rate. The difference in yield was less than 5 per cent of the total in favor of the cowpea mixture.

Observations on the relation of cowpea growing to wheat production on continuously cropped land, made by C. A. LeClair, indicated that where wheat is grown continuously and cowpeas are planted after each crop a better yield of wheat is obtained than if the soil is fallowed.

In experiments with corn and cowpeas, conducted by M. F. Miller and C. A. LeClair, the results of two years' work showed that if corn and cowpeas are seeded together at the same time the growth of both plants is limited. A decrease in the percentage of nitrogen in the ear of corn resulted when cowpeas were planted in the row with corn, while where the cowpeas were drilled between the rows at the last cultivation a slight increase in the nitrogen content of the ear resulted. For the two years there was also an increase in yield of 3 bu. to the acre, and an increase in the amount of stover in proportion to that of the grain.

A study of factors influencing the development of the maize plant, made by M. F. Miller and J. C. Hackleman, indicated that with reference to both moisture and nutrition the second period, from the time when the corn is normally laid by until the silks appear, is the most important in the growth of the plant. It was found that leaf growth was influenced more than stalk growth by the variation in the nutrient elements. With reference to variation in the moisture supply, the second period was generally the most important of the three in influencing ear development and total dry matter. The lowest water requirement was found where an optimum supply was maintained during the first period with a minimum supply during the last two periods, while the highest was observed where the water supply was kept at the optimum through all three periods.

Farming practice in the sand hills section of Nebraska, J. Cowan (*Nebraska Sta. Bul. 156 (1916), pp. 67, figs. 9*).—A brief history of the Valentine substation is given, the sand hills section of Nebraska and the farming practices followed are described, and the results of experiments with crops and with crop management are presented.

Alfalfa is reported as the most valuable forage crop for the region, exceeding all clovers, including sweet clover, which was found better adapted to hardpan lands than to the sand hills lands. Alsike with red clover seemed well adapted to the wet valleys of the region. Stands of slender wheat, brome, and western wheat grasses were secured on cultivated ground, but the production of hay was small. Sudan grass gave a yield per acre of 1,667 lbs. of hay on light, sandy soil when sown in rows 21 in. apart, and 1,649 lbs. per acre when sown broadcast.

Among the grain sorghums, the upright-headed dwarf milo maize yielded 11.2 bu. per acre on light soil in 1913, this being the highest yield in three years. Corn under similar conditions yielded 13.6 bu. per acre, the best yielding variety being Minnesota No. 13. Yields per acre of 11.8 bu. of winter rye, 11.5 bu. of emmer, and 11.3 bu. of winter wheat, are recorded.

The leading variety of potatoes was Irish Cobbler. The best depth of planting in light, sandy soil was from 4 to 5 in., the best spacing of rows 42 in., and the best spacing of plants in the row 24 in. Potatoes from seed grown under mulch yielded 13 bu. per acre more than those from seed produced in the ordinary way. On light, sandy soil under a mulch of 6 in. of hay, the yield was increased 50 per cent as compared with ordinary methods of culture.

The data pertaining to horticulture and forestry are noted on pages 835 to 842 of this issue.

The work of the San Antonio experiment farm in 1915, S. H. Hastings (*U. S. Dept. Agr., Bur. Plant Indus., Work San Antonio Expt. Farm, 1915, pp. 17, figs. 2*).—A report is given of work continued along the same general lines followed in preceding years (E. S. R., 33, p. 830). The seasonal conditions are noted, the meteorological observations made at the station from 1907 to 1915, inclusive, are summarized in tables, and experiments relating to rotation and tillage, the culture of corn, cotton, field peas, and flax, and the pasturing of oats are described.

Results from the rotation and tillage work secured thus far indicated that the time of plowing has been of more consequence than the effect of the preceding crop, and that plowing should be done early, at least before January of the year in which the crop is to be planted. Cotton and corn generally gave inferior results when following a crop of sorghum.

A comparison of methods of soil preparation conducted in this connection showed that disking may often take the place of plowing and that fall disking

may be preferable to spring plowing. In 1915 cotton on disked corn ground yielded at the rate of 696 lbs. of seed cotton per acre, while cotton on spring-plowed corn ground yielded at the rate of 464 lbs. The average yield of seed cotton per acre in a rotation where cotton was grown on disked corn land from 1910 to 1915, inclusive, is reported as 661 lbs. as compared with 592 lbs. in a rotation in which cotton was grown on spring-plowed corn land and 629 lbs. in the rotation where cotton was planted on corn land plowed in August of the preceding year. In 1915 subsoiling apparently decreased slightly the yields of all crops, and for the period from 1910 to 1915, inclusive, the average yields from all crops were also slightly less on land subsoiled than on land not so treated. The use of manure gave more beneficial results on land used continuously for the same crops than where crops were grown in rotation, and it had a more favorable effect on the yields of cotton than on those of other crops, but in none of the tests was the increased yield sufficient to justify the expense of the treatment.

Field peas planted in the fall of 1914 made a good growth during the winter and produced a heavy crop for turning under in the spring. The quantity of green material produced on the average of five plats was estimated at 10.6 tons per acre. On one plat the peas yielded at the rate of 2,888 lbs. of field-cured hay per acre. In these experiments cotton yields have been less from the plat where rye was used as a green manure than in similar rotations where no green manuring was practiced.

Growing a crop in alternate years with clean fallow between crops was not found profitable in the production of corn, cotton, or oats for grain. The method resulted in lowering the yields of both corn and cotton as compared with the yields of these crops grown continuously on comparable plats.

In studying the effect of rotation and tillage on root rot in cotton, it was found that the disease is less serious in cotton grown in rotation with other crops such as corn or oats than when grown continuously on the same land. On a plat cropped continuously to cotton for seven years 25.7 per cent of the plants died from root rot by the time the first picking was made in 1915, and at the time of the second picking about six weeks later 49.7 per cent of the total number of plants had died. The damage from root rot on this plat has increased each year since 1912 when only about 1 per cent of the plants succumbed. On plats where cotton was grown on fall-plowed land in rotations, including corn, sorghum, or oats, there was little or no root rot. Other results secured indicated that the application of barnyard manure has a tendency to check the spread of the disease. It was further observed that subsoiling appeared to have a tendency to reduce the injury in cotton grown on spring-plowed land, but it is not believed that this effect of subsoiling would offset the cost of the work.

In a variety test with corn the highest yield was made by Laguna, followed by Brazos and Old Glory, both Laguna crosses. In a test of planting corn in rows at different distances and of interplanting with cowpeas it was found that where no cowpeas were planted between the rows the yield of corn rose generally as the distance between the rows increased, the highest yield being obtained where the rows were 7 ft. apart and with 4,078 plants per acre, and the lowest where the rows were 4 ft. apart and with 4,480 plants per acre. When the cowpeas were planted after the corn had a good start the growing of a row of cowpeas between the rows of corn did not lower the yield of corn.

Cotton grown in rows 3, 4, 5, 6, and 7 ft. apart with the plants about 6 in. apart in the row gave an average yield of seed cotton about 50 per cent greater in the 7-foot rows than in the 3-foot rows.

Experiments conducted with varieties of field peas indicated the Golden Vine to be above the average in yielding capacity. Kaiser, Gray Winter, Wisconsin Blue, Andes, and Blue Imperial made an excellent growth and appeared to be well adapted to the conditions.

Results obtained with flax in 1915 indicated that for conditions similar to those at San Antonio northern-grown flax varieties, if sown in the winter, may prove as promising as the imported winter types. C. I. No. 13, the only northern strain grown in nursery rows, appeared most promising early in May. Smyrna flax, C. I. No. 30, grown on a field plat yielded at the rate of 11.9 bu. per acre.

The results of an experiment on using oats for pasture indicated that pasturing as late as March 10 had a detrimental effect upon the yield of both grain and hay. A plat pastured from February 7 to February 20 gave the highest yield of grain but a slightly lower yield of hay than plats which were not pastured.

Farm crops work, A. C. Hartenbower (*Guam Sta. Rpt. 1915, pp. 16–21, pls. 2*).—A general description is given of work with cotton and forage crops. The requirements of a successful variety of corn for Guam conditions are discussed, and the results of trials with types and varieties of cotton and with grasses and other forage crops are reported.

The highest yield of seed cotton, 1,641 lbs. per acre, was secured from Egyptian Yuma. The Egyptian type, as indicated by station results, appears superior to Sea Island under the prevailing soil and climatic conditions. Observations on late planting and on ratooning of cotton are noted.

Among the grasses tested Para grass gave the best results. Under exceptionally dry conditions it grew about 3 ft. high, although cut about every five weeks from the latter part of April to the end of June. Feterita and Kafir corn were planted November 12, 1914, and January 8, 1915. In the first test feterita was ready for harvesting February 4, 1915, and Kafir corn about 8 days later, while in the second test feterita reached maturity March 23, 1915, and Kafir corn March 28. The first crop of feterita thus required 84 days to mature and the second, which produced considerably less forage, only 74. Soil tests with *Paspalum dilatatum* indicated that on the better soils this grass will support from two to three times as many cattle as the native grasses. On the poorer soils it was found that heavy pasturing destroys the stand. The cost of planting Paspalum, including plowing and otherwise preparing the soil and hauling and setting the roots, was determined to be about $16 per acre.

[Breeding work with velvet beans and corn], J. Belling (*Florida Sta. Rpt. 1915, pp. CVII–CXXXI, figs. 3*).—The plant breeding work pursued during the year was confined largely to inheritance and selection studies with velvet bean hybrids, including the fourth and fifth generations. Special attention was given to the inheritance of mottling of the seed coat and the breeding of selected lines to bring about constancy in this character. The behavior of the character in the different generations of the various crosses is discussed at some length. The different hybrids studied were: Florida × Yokohama, Florida × Chinese, Florida × Lyon, and Lyon × Florida.

It was found that the hybridized seeds on the parent Florida or Lyon plants were indistinguishable in appearance from selfed seeds on the same plant, and the author therefore regards seed mottling as a somatic character of the plant which bears the seeds. The Florida-Lyon crosses showed remarkable variation in dominance in the first generation and some of the second generation plants, but this variation seemed to occur solely with mottling. In the third generation of the Lyon-Florida cross the mottled plants were often

bicolor and more or less inherited the parental amount of pigment, which is considered as proving that there are three genetic differences in this cross concerned with pigment in the seed coat.

Data secured in studying the inheritance of the length of pod in the Florida-Yokohama cross are also reported.

In breeding corn, crosses were made between the best West Indian variety and the best varieties of north Florida, Georgia, and Alabama. Selection was made for pure white, flinty, deep, and fairly large grains, long, compact, and drooping ears, with about twelve straight rows and tightly fitting husks, narrow cob, and two good ears on the stalk. In the fourth generation of a cross between Mosby and Cuban a plant was found meeting all the requirements, but in the fifth generation in 1915 some undesirable qualities appeared which are to be eliminated by further selection.

A cross between Cuban field corn and Black Mexican sweet corn was selected for white, well-wrinkled, translucent grains, ears with about twelve rows, and good growth in hot weather. A type of sweet corn was developed which seems to grow better in central Florida when planted late than either Black Mexican, Stowell Evergreen, or Country Gentleman.

A cross between Mosby field corn and Black Mexican sweet corn was made for the purpose of developing a sweet corn having white, well-wrinkled, translucent, and large grains, and six-rowed, long ears. The selected second-generation stalk was six-rowed, as were all subsequent ears.

Commercial varieties of alfalfa, R. A. Oakley and H. L. Westover (*U. S. Dept. Agr., Farmers' Bul. 757 (1916), pp. 24, figs. 7*).—This describes the commercial varieties of alfalfa as divided into five groups, the common, Turkestan, variegated, nonhardy, and yellow-flowered groups. The history, cultural status, characters, adaptation, and value of each group and the principal varieties and strains it includes are noted. Varieties and strains recommended for various sections of the United States are enumerated, and directions for purchasing seed are given. Seed production and possibilities in breeding are briefly discussed.

Transplanting alfalfa, N. E. Hansen (*South Dakota Sta. Bul. 167 (1916), pp. 424–445, figs. 9*).—This bulletin discusses in a general and popular way the transplanting of alfalfa by means of transplanting machines and by hand, gives directions for digging, storing, and shipping plants for transplanting, and enumerates the reasons why the practice is desirable.

Report on corn and cotton varieties at the Georgia Experiment Station for 1915, C. K. McClelland (*Georgia Sta. Circ. 74 (1916), pp. 8*).—The usual variety trials with corn and cotton for the year 1915 are described, and the results of the different varieties are listed.

The 16 varieties of corn under test ranged in yield from 24.3 bu. to 33.7 bu. per acre, produced by Virginia Ensilage and Steinheimer Marlboro, respectively. The strains of Marlboro corn again demonstrated the superiority of the variety. The earlier maturing varieties such as Virginia Ensilage, Mexican June, and Hickory King appeared at the foot of the list.

The yields of 45 short-staple and 5 long-staple varieties of cotton are reported. Cleveland Big Boll ranked first in yield of seed cotton per acre, but considerable variation in the different strains of seed of this variety was observed.

[Cane.—Fertilizer and composition studies], J. M. Scott (*Florida Sta. Rpt. 1915, pp. XXIV–XXXI*).—A fertilizer experiment with Japanese cane, previously described (E. S. R., 34, p. 831), is reported and the results of six crops grown since 1909 are given in tables. The data presented confirm earlier conclusions and recommendations. A second fertilizer experiment with Japanese cane begun in 1914 is briefly described and the first year's results are tabulated.

Analyses reported of maiden cane (*Panicum hemitimomum*) at different stages of maturity show that during the early stages of growth this grass is rich in feeding value.

Studies on oat breeding.—IV, Pure line varieties, F. M. SURFACE and J. ZINN (*Maine Sta. Bul. 250 (1916), pp. 95–148, pls. 2, figs. 5*).—This bulletin defines and illustrates the meaning of a pure line, discusses the general methods used in the pure-line breeding of cereals, and describes work in oat breeding begun in 1910 with 460 individual oat plants representing 18 different commercial varieties. A method used for correcting the yield of individual plats for differences in soil fertility is also briefly outlined. Similar work has been previously noted (E. S. R., 32, p. 38; 35, p. 33).

By means of selection the number of pure lines in 1915 had been reduced to 12, representing only 3 of the original commercial varieties, Banner, Irish Victor, and Imported Scotch. The results for three years, given in tables, show that these pure lines averaged in yield 80.8 bu. per acre against 75.2 bu. for 11 commercial varieties, only 4 of which gave a better yield than the poorest of the pure lines. In all cases the average yield of the pure lines selected from a given variety exceeded the yield of the parent variety. As the pure lines closely resemble their respective parent varieties in morphological characters, such as type of head, character of grain, and other features, the changes in the physiological characters which result in higher yield are regarded as not necessarily associated with morphological characters in the plant or grain.

Of the 12 pure lines, Maine 340, an Irish Victor selection with an especially stiff straw, a high weight per bushel and per 1,000 kernels, and a relatively low hull percentage, is regarded as the best for conditions of the experiment, although standing second in average yield. Maine 355, a Banner selection, ranked second in value and gave the best average yield of any of the lines, but it has a slight tendency to lodge on heavy soil. Maine 247, 286, and 357 appeared slightly inferior to the rest in yielding capacity. It is stated that each of the 12 pure lines is well adapted to conditions in the southern and central part of Maine, and that, being bred from single plants, they tend to ripen much more evenly and are more uniform in all their characters than most commercial varieties.

Irish potato spraying, H. P. STUCKEY and B. B. HIGGINS (*Georgia Sta. Bul. 123 (1916), pp. 115–124, figs. 4*).—Spraying tests carried on in 1915 and 1916 are described and the results, including the cost of spraying each season, are reported.

While the outcome of the two years' tests is not regarded as warranting very definite conclusions, it is considered as indicating that early blight may be very destructive and that during such seasons spraying with Bordeaux mixture as well as arsenate of lead may be practiced successfully. Two applications of mixed Bordeaux and arsenate of lead were found sufficient for controlling both early blight and potato beetles on early-maturing varieties, and it is recommended that the first application be made when the plants are about 6 to 8 in. high and the second about three weeks later.

Lime-sulphur versus Bordeaux mixture as a spray for potatoes, IV, M. T. MUNN (*New York State Sta. Bul. 421 (1916), pp. 311–317, pl. 1; abs. (1916), pp. 2*).—This bulletin describes experiments conducted in 1915 in continuation of work pursued the four preceding years and previously noted (E. S. R., 33, p. 40).

The results are reported as agreeing essentially with those previously obtained, showing that lime-sulphur is harmful rather than beneficial to potatoes. Bordeaux mixture prevented tipburn to a considerable extent, made the foliage

darker green, prolonged the growing period, increased the yield, and materially checked the ravages of late blight caused by the fungus *Phytophthora infestans*, while lime-sulphur aggravated tipburn, dwarfed the plants, shortened the growing period, reduced the yield, and proved valueless as a preventive of the disease. The average results for the five years show an increase of 68.8 bu. of marketable tubers per acre ascribed to spraying with Bordeaux mixture as compared with a decrease in yield of 25.8 bu. ascribed to spraying with lime-sulphur solution.

Culture of rye in the eastern half of the United States, C. E. Leighty (*U. S. Dept. Agr., Farmers' Bul. 756 (1916), pp. 16, figs. 8*).—This describes varieties of rye adapted to the cotton belt and the Northern States in the eastern section of the country, and discusses the production of the crop. The following varieties are reported as having given an excess of 30 bu. per acre for the three or four years that they were grown at Arlington Farm, Va.: Giant Winter, Abruzzes, Arlington Winter, Virginia Winter, Mexican, Rimpau, Ivanof, and Henry. In the discussion of the producing of the crop the soils adapted to rye, the place of rye in the rotation, the preparation of the seed bed, the use of fertilizers, preparation of the seed, time, method, and rate of seeding, and the methods of harvesting are noted. The pests affecting the crop and their control are also briefly mentioned.

New sorghum varieties for the central and southern Great Plains, H. N. Vinall and R. W. Edwards (*U. S. Dept. Agr. Bul. 383 (1916), pp. 15, figs. 7*).—A description is given of Dwarf hegari, Improved feterita, Dwarf feterita, White milo maize, and Schrock Kafir corn, and a comparison is shown in a table of the field records of these sorghums at Chillicothe and Amarillo, Tex., from 1913 to 1915, inclusive, and at Hays, Kans., for the years 1914 and 1915. The three-year period included a wet year, a dry year, and one of average weather conditions. The value of the varieties in different portions of the Great Plains is discussed and general conclusions are drawn.

It is pointed out that Schrock Kafir corn has a long growing season and therefore yields best in the southern portion of the Great Plains. While producing good yields under favorable conditions it does not furnish at the same time a good quality of grain, as its seeds contain an appreciable amount of tannin. Dwarf hegari is recommended for the whole sorghum region in Texas lying south and east of the Panhandle. Dwarf feterita and Improved feterita gave better results than ordinary feterita and are regarded as generally promising a larger grain yield than either Dwarf milo maize or Dwarf Kafir corn on the high plains of northwestern Texas, western Kansas, and eastern Colorado. White milo maize produced very satisfactory yields of grain and while the fodder furnished is rather inferior in quality, it is considered worthy of more extensive planting in northwestern Texas, western Oklahoma, western Kansas, eastern Colorado, and western Nebraska.

A study of Colorado wheat, II, W. P. Headden (*Colorado Sta. Bul. 217 (1916), pp. 3–46*).—The work here reported, conducted in 1915, is in continuation of investigations carried on in 1913 and described in Bulletin 208 of the station, already noted (E. S. R., 33, p. 637). A study of the composition of the wheat plant and the effects of fertilizers are presented, together with a general statement of the weather conditions for the two seasons. No further study of the bacteriology of the soil reported in the bulletin mentioned was made. A summary of the results, including the data collected in 1913, is given.

The land used for these experiments, as determined in 1913, contained a liberal supply of total potash, 101.6 tons in the upper 2 ft. of soil, with approximately 1 ton available at that time. The quantity of hydrochloric acid-soluble potash indicated over 25 tons available. The citric acid-soluble phosphoric acid was

about 1,400 lbs. and the hydrochloric acid-soluble 9,800 lbs. The total nitrogen found in the same depth of soil was 8,240 lbs. While the nitrogen was not considered remarkably high, it was shown that a very considerable portion of it actually existed in the soil in the form of nitric nitrogen at the time of planting, the upper 2 ft. containing nitric nitrogen equivalent to 211 lbs. of sodium nitrate.

The power of this soil to fix nitrogen was discussed in previous publications (E. S. R., 25, pp. 814, 815). It was found at that time that in 27 days a sample of this soil simply kept in a moderately warm room gained 4.82 mg. of nitrogen for each 100 gm. of soil, or 48 parts per million; this was equivalent to the addition of 192.8 lbs. of nitrogen or of about 1,100 lbs. of sodium nitrate to an acre-foot of soil in one month.

In both seasons the effects of irrigation on the distribution of the nitrates were determined. On April 29, 1913, before irrigation, a soil sample in the upper 4 ft. was found to contain nitric nitrogen equivalent to 1,908 lbs. of sodium nitrate, while another sample taken the same day from the same depth of soil contained the equivalent of 471 lbs., but with a total additional equivalent of 721 lbs. in the seventh, eighth, and ninth foot. On June 27, 13 days after irrigation, the upper 4 ft. of three different sections of soil were found to contain 162, 91, and 156 lbs., respectively, with a maximum of 30 lbs. below 4 ft. in three borings taken to a depth of 12 ft., and a minimum of zero. The season of 1913 had a high rainfall in general, but with long periods without any precipitation, while in 1915 the total rainfall was as large again and well distributed in a succession of light showers throughout the season. Soil samples taken at the end of June, 1915, were found to contain, even in the fourth foot, nitric nitrogen as high as equivalent to 48 lbs. of sodium nitrate, while by August 3, at the beginning of the ripening of the grain, the surface foot contained the equivalent of only about 20 lbs., the minimum found in the fourth foot at this time being zero. Samples taken from fallow ground on August 3, 1915, showed a nitric nitrogen content equivalent to 285.5 lbs. of sodium nitrate, while a sample from cropped land taken to the same depth at the same time gave an equivalent of 46.9 lbs. "The crop, either by preventing the formation of the nitrates or by using them up, had made a difference equal to 238.6 lbs. of sodium nitrate in this depth of soil."

Investigations showing the nitrifying efficiency of this soil have been previously noted (E. S. R., 25, p. 814; 30, p. 818). Three sets of soil samples taken from fallow land to a depth of 19 in. on August 1, 1913, showed a nitric nitrogen content equal to 542.43 lbs. of sodium nitrate per acre. The nitric nitrogen of samples taken the same date from cropped land to a depth of 2 ft. corresponding to 101.2 lbs., and samples taken December 4, 1914, to a depth of 19 in. on the same plat, after harvesting a crop of wheat August 6, irrigating the land August 28, and plowing it November 14, gave an equivalent of 299.35 lbs. It is pointed out that the difference in nitric nitrogen as compared with the fallowed land was equal to 243 lbs. of sodium nitrate in favor of the latter, and that the difference between 299.35 lbs. and 101.2 lbs. of sodium nitrate gives an approximation to the difference in the amount of nitric nitrogen in the upper 2 ft. of soil on August 1 and December 4. Studies along this line more closely followed in 1915 gave similar and equally positive results. The cropped land again contained its minimum amount of nitric nitrogen about August 1. Data arranged in tables indicate a rapid fall of the nitric nitrogen in the cropped land from the middle of May to the beginning of August, or during the growing period of the plant.

The total nitrogen was also determined and the data secured are given in tables, without interpretation of the results because of the difficulty of obtaining samples of soil varying by less than the amount of nitrogen concerned in

this study. A study of 150 sq. ft. of soil sampled by taking a core from the center of each square foot to a depth of 12 in. brought out the fact that it was rarely the case that contiguous square feet of soil showed so small a difference in total nitrogen as 0.001 per cent. The actual difference reached 0.0354 per cent, or more than 35 times as much as would have a considerable significance in the development of the crop, if present in the form of nitric nitrogen.

A study of the effect on the composition of the plant of different amounts of water applied to the soil, the composition of two series of samples which received 30.77 in. of water in all, 24 in. irrigation and 6.77 in. rainfall, being compared with the composition of 16 series grown with 18.77 in. of water, 12 in. irrigation and 6.77 in. of rainfall, brought out no differences in the amount of nitrogenous compounds in the plants that could be attributed to the varying amounts of water applied. In 1915, when the crop again received about 19 in. of water, differences in the composition of the plants up to the end of July were considered due to the fact that plants were thoroughly moistened by application of water almost daily as the result of the prevailing weather conditions. Later the abundant development of rust as a result largely of the moisture on the plants began to play a still more important part in this direction. The general effect was to suppress all forms of nitrogen present in the plant as well as the ash constituents throughout its growing period. The size of the plants and the percentage of dry matter were not materially different in the two seasons.

The very different weather conditions prevailing during the two seasons are believed to have demonstrated that the observed effects of the fertilizers applied in 1913 are independent of the weather. It is further stated that while the weather conditions of 1915 made great differences in both the nitrogen compounds and ash constituents of the plants, they did not obscure the effect of the nitrogen applied on the total, or the proteid nitrogen, or the silicon, or the ash constituents in general. The same is regarded true with respect to the effects of phosphorus and potassium. It is stated that the effect of the application of nitrogen was to increase the nitrogen in all parts of the plant, to reduce the percentage of dry matter and the percentage of silicon, to increase the percentage of potassium, calcium, and magnesium, as a rule, to increase also the total ash, and to remain neutral relative to the amount of phosphorus in the plant. The application of nitrogen is reported also as increasing the height of the plant, the length of the head, and the color of the plant, but as not increasing the kernels per spikelet. Phosphorus seemed to be indifferent to or possibly tended to depress the amount of the nitrogen in the different parts of the plant, and the same was true of potassium, except that this element showed a stronger tendency to depress the nitrogen. Both phosphorus and potassium depressed the phosphorus in the plant. These effects upon the composition of the plant were apparently not changed by the weather conditions. The effect of the application of nitrogen in the form of sodium nitrate in the production of flinty and often shrunken kernels was not changed in the wet season of 1915. The weather conditions of 1915 as compared with those of 1913 are further considered as having been without material effect on the occurrence of yellow-berry. The attack of rust seemed to affect materially the course of the chemical changes that took place after the early part of August, 1915, as compared with those taking place during the ripening period of the plant in 1913.

Distinguishing characters of the seeds of Sudan grass and Johnson grass, F. H. HILLMAN (*U. S. Dept. Agr. Bul. 406 (1916), pp. 5, figs. 5*).—This bulletin enumerates and describes the distinguishing characters of seeds of Sudan grass and Johnson grass, and points out the apparent exceptions to these characters.

Second annual report of the state grain laboratory of Montana, A. ATKINSON and B. W. WHITLOCK (*Montana Sta. Bul. 108 (1915), pp. 129–148, figs. 7*).—The work of the year ended September 30, 1915, included the handling of 2,570 seed samples, of which 2,306 were tested for germination and purity, making 160 laboratory and field tests to determine the percentage of germination of hard seeds of legumes, inspecting 35 fields of flax and one of alfalfa grown from pedigreed seed, conducting milling and baking tests of wheat, and collecting data on the more important weeds of the State. The results of the different tests are tabulated, and the number of seed samples of 12 common crops tested for purity and containing seeds of the 50 most common weeds are listed.

The New Jersey seed law, J. P. HELYAR (*New Jersey Stas. Circ. 59 (1916), pp. 3–12*).—The text of the 1916 act regulating the sale of agricultural seeds in New Jersey is given and requirements are explained.

Weed control, J. P. HELYAR (*New Jersey Stas. Circ. 60 (1916), pp. 3–12*).—A popular article, treating briefly of the weed problem in general and presenting notes on the classification of weeds, methods of control including the control of dodder and of weeds in lawns, and the use of chemical weed destroyers.

HORTICULTURE.

Fungoid and insect pests of the farm, F. R. PETHERBRIDGE (*Cambridge, England: University Press, 1916, pp. VII+174, figs. 54*).—A practical treatise on farm and garden diseases and pests and their control. The work covers general farm crops as well as fruits and vegetables.

[Fruits, vegetables, and lawns in the sand hills], J. COWAN (*Nebraska Sta. Bul. 156 (1916), pp. 60–65*).—Suggestions are given relative to varieties and cultural practices based upon work conducted at the Valentine Substation.

Suggestions to growers and shippers of fruits and vegetables as to the best methods of preparation, loading, stowing, stripping, and bracing for safe transportation (*Com. Ry. and S. S. Refrig., Amer. Assoc. Refrig. Bul. 3 (1916), pp. 31, figs. 27*).—A compilation of information dealing with various phases of the transportation problem as affecting the shipment of fruits and vegetables.

Report on the statistics of vineyards, orchards and gardens, and root crops for the season 1915–16, W. L. JOHNSTON (*So. Aust. Statis. Dept. Bul. 3 (1916), pp. 6*).—A statistical report on the area and production of vineyards, orchards and gardens, and root crops for the season 1915–16, including comparative data for the previous four years.

Guide and catalogue of the Madagascar Experiment Station at Ivoloina (*Guide et Catalogue de la Station de l'Ivoloina. Tananarivo: Govt., 1916, pp. 23, pl. 1*).—In addition to general information relative to the station, a descriptive catalogue is given of economic plants grown there.

Asparagus in California, the culture, marketing problems, and history, W. F. BAILEY (*State Com. Market Cal. Bul. 1 (1916), pp. 23*).—A short general account of the fresh asparagus and asparagus canning industries of California, including a discussion of methods employed, cost of production, and marketing statistics.

Studies on the dying out of pepper vines in the Dutch East Indies.—II, Pepper cultivation in Banka, A. A. L. RUTGERS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Lab. Plantenziekten, No. 19 (1916), pp. 36, pls. 16*).—In continuation of a previous paper (E. S. R., 35, p. 349) results are given of a survey of the pepper industry in Banka, including the history and extent of the industry, methods of cultivation, and prevalent diseases and pests of peppers.

A genetic study of plant height in Phaseolus vulgaris, R. A. EMERSON (*Nebraska Sta. Research Bul. 7 (1916), pp. 8–73, figs. 16*).—In this paper the author analyzes the factors concerned in height of plants in beans and discusses the mode of inheritance of these factors as determined by a study of the progeny of crosses between pole and bush beans of varying heights. The methods employed in breeding, making records, etc., are described in detail and a bibliography of cited literature is given.

The results of the investigations as a whole show that pole and bush beans differ in a single character, habit of growth. Bush beans are determinate and pole beans indeterminate in growth habit. The indeterminate habit of growth is fully dominant to the determinate habit. Following the Mendelian ratio the determinate habit is constant in F_3, while some indeterminate F_2 plants breed true in F_3 and others segregate again into pole and bush plants. In addition to their indirect relation to habit of growth the two characters, number of internodes and internode length, are in a way distinct from habit of growth. There are distinct types of both bush and pole beans in respect to both number of internodes and internode length. Crosses of bush beans of different internode lengths, as well as crosses of pole beans of different internode lengths, result in an intermediate condition in F_1 and a wider range of variation in F_2 with respect to internode length.

In a short pole bean and tall bush bean cross, tall pole beans are dominant in F_1. Some of the pole bean segregates have fewer and shorter internodes than the pole bean parent and some of the bush bean segregates have more and longer internodes than the bush bean parent. Similar results follow when a tall pole bean is crossed with a short bush bean. The dominance of indeterminate over determinate habit of growth is interpreted just as are other simple Mendelian results, namely, on the basis of a single dominant, genetic factor for the difference between the parents in habit of growth. The intermediate height in F_1 and the wide range of variation in F_2, from a cross between two bush beans or between two pole beans of different heights, are interpreted in accordance with the multiple-factor hypothesis. Segregation into three plants with indeterminate habit to one of determinate habit, accompanied by an increased range of variation in height of both classes of segregates when a short pole bean is crossed with a tall bush bean or tall pole bean with a short bush bean, is interpreted by a combination of the single-factor and the multiple-factor hypotheses, or by what may be termed a modified multiple-factor hypothesis, the modification consisting merely in the assumption of inequality in dominance and inequality in potency between the factors.

The author believes that this modified multiple-factor hypothesis affords a more simple and direct interpretation of the results in these crosses than does the hypothesis of a single unit-difference between all pole and bush beans, which necessitates the further assumption that the unit-factor is modified commonly, though irregularly, in crosses between pole and bush beans.

The fruit industry in New York State, compiled by E. VAN ALSTYNE (*N. Y. Dept. Agr. Bul. 79 (1916), pts. 1, pp. 627–981, pls. 2, figs. 124; 2, pp. 981–1432, pls. 14, figs. 189*).—This bulletin comprises as a whole a manual of information relative to the fruit industry of New York State. The subject matter has been prepared by various horticultural investigators, both within and without the State, as well as by many practical fruit growers. Part 1 treats of the fruit industry of the State in all its phases, followed by detailed information relative to the commercial production and handling of apples. Part 2 treats, in a manner similar to apples, of pears, peaches, cherries, plums, prunes, quinces, grapes, and small fruits. The bulletin concludes with an article on fruits in the home.

Notes on Argentine fruit culture, C. D. GIROLA (*Bol. Min. Agr. [Buenos Aires], 20 (1916), No. 5–6, pp. 364–371, pls. 6*).—This comprises descriptive notes on a number of fruits commonly grown in Argentina.

[Progress report on horticultural investigations] (*Missouri Sta. Bul. 141 (1916), pp. 32, 33, 34–36*).—This comprises concise statements of progress made along various lines of horticultural work during the year ended June 30, 1915.

In the orchard nutrition studies by J. C. Whitten and C. C. Wiggans no data were secured on peaches, spring frosts having killed the buds. In a part of the work, which was conducted in pots containing south Missouri soil, nitrogen applied as a fertilizer seemed to increase the number of apples on young trees just beginning to bear. At the same time apple blight attacked more severely the trees fertilized with nitrogen. No appreciable results were secured with potash or phosphoric acid, either alone or in combination with nitrogen, the complete mixture being somewhat better than the single elements, except nitrogen.

The results of the cooperative spraying experiments have been previously noted (E. S. R., 33, p. 45).

In the work of breeding peaches for hardy sorts by J. C. Whitten a few of the earlier crosses came into bearing. During the past winter a self-fertilized Lewis tree was able to bring 16 per cent of its buds through a temperature of —12.8°, whereas on all of the leading commercial varieties at least 98 per cent were killed and in most cases 100 per cent.

Observations on the self-fertility and self-sterility of fruits by J. C. Whitten and C. C. Wiggans indicate, as previously noted, that the commercial varieties of apples show a tendency to self-sterility, especially in certain years.

Studies on fruit bud development of fruit trees as influenced by treatments and previous crops by C. C. Wiggans were started in 1913 on the varieties Gano, Rome, and Jonathan, the spurs which set fruit being labeled in July. A record of these spurs taken in 1914 shows that a great majority of the spurs on trees of these varieties are not able to bear fruit two years in succession. The work was extended to additional varieties in 1915. During the winter and early spring of 1915 several freezing point determinations of sap from spurs bearing fruit in 1914 and also from spurs not bearing in 1914 were made. In every case the sap from bearing twigs froze at a lower point than from nonbearing twigs. At the same time the variety and the kind of soil seemed to have considerable influence. The sap studies were continued throughout 1915. Some young Jonathan apple trees were etherized at various times to determine the effect on fruit bud formation, but up to June 30, 1915, etherization had not resulted in any increase in sap concentration.

A test of fall *v.* spring planting of fruit trees by J. C. Whitten has shown the advantage of fall transplanting over spring transplanting to be more marked in the case of cherries than in any other fruit, although previous results indicating the advantage of fall planting over spring planting for other hardy fruit varieties have been confirmed.

Fruit tree root systems, A. B. BALLANTYNE (*Utah Sta. Bul. 143 (1916), pp. 3–15, figs. 5*).—This reports a study of a number of root systems of fruit trees removed from an orchard damaged by seepage conditions in the soil.

An examination of the root systems indicate that fruit trees may ordinarily be expected to send their roots deeply into the ground if the water supply is not too plentiful, especially near the surface, and the ground water level is not too high. The natural depth of fruit tree roots as indicated in this study is probably near the height of the tree. The method and amount of watering will alter the general shape of the root system and make it essentially a deep-

rooted tree or a shallow-rooted one. Properly spreading the roots at planting time may assist in developing a more symmetrical root system. In applying irrigation water the amount of water should be sufficient to keep the surface moist without adding to the supply below.

Recent developments in spraying practices, P. J. Parrott (*Mass. Fruit Growers' Assoc. Rpt., 22 (1916), pp. 79–120*).—A paper, with a discussion following, in which the author considers the spraying problems confronting the fruit growers of New York State and methods that have been employed by the New York State Experiment Station to meet these problems. The subject matter is discussed under the general headings of the plant lice injurious to apple foliage and fruit, insects that factor in the grading of apples, the insecticidal properties of various sulphids and polysulphids, compatibilities of common insecticides, and the cost of spraying in the upkeep of an apple orchard.

A study of variation in apples during the growing season, W. E. Whitehouse (*Oregon Sta. Bul. 134 (1916), pp. 3–13*).—This bulletin gives a summarized account of an investigation conducted to determine whether there are more or less definite periods when apples under Oregon conditions make their main increase in bulk and other periods when their characteristic color markings are developed.

Summing up the detailed data secured by measurements of apples representing four distinct pomological groups, the author finds that apples tend to make a gradual increase in diameter from the commencement of growth with a correspondingly greater increase in volume as the diameter increases, and consequently actually greater increases in volume occur during the latter part of the growing season than in the early stages.

In the case of color development there is a time during the middle of the growing season when color is less developed than in the early stages of growth. A large part of the coloring matter of apples is deposited shortly before picking time. From the viewpoint of securing higher color it is suggested that picking could often be delayed several days to advantage.

In view of the steady gradual increase in size the ideal cultural conditions are those which provide a constant supply of moisture. The author also found that the relative size and the general shape as between individual apples in the early stages of growth is maintained to the picking time. Consequently, in thinning apples undesirable shapes and the smaller fruits should be removed.

The packing of apples in barrels and boxes, W. H. Wolff (*N. H. Col. Ext. Bul. 7 (1916), pp. 32, figs. 43*).—In addition to a technical account of methods of packing apples in barrels and boxes, the author reviews the legal measures which have been taken in this country to regulate the grading and packing of apples. The text of the United States apple grading law and the Massachusetts apple packing and grading law is appended.

Cranberry improvement, F. P. Schlatter (*Proc. Amer. Cranberry Growers' Assoc., 47 (1916), pp. 12–16*).—In this paper the author discusses methods of improving the cranberry through plant selection and propagation, seed selection and propagation, and crossbreeding, and outlines investigations to be conducted along this line under the direction of the New Jersey Experiment Stations.

The direct bearers of the National School of Agriculture, Montpellier, G. Verge (*Ann. École Nat. Agr. Montpellier, n. ser., 14 (1914), Nos. 1, pp. 25–80; 2, pp. 81–168, figs. 13*).—A summary of observations made during the past fifteen years on direct-producing hybrid grapes growing in the Montpellier experimental vineyard, previously noted from another source (E. S. R., 31, p. 238).

The history of the Viticultural Station of Lausanne, 1886–1916, H. FAES and F. PORCHET (*La Station Viticole Cantonale Vaudoise de Lausanne dès Sa Fondation à Son Transfert à la Confédération Suisse, 1886–1916. Lausanne: Dept. Vaud. Agr., 1916, pp. 107, pls. 2, figs. 12*).—This comprises a retrospective study of the Viticultural Station of Lausanne with reference to its organization, investigations, publications, and participation in the development and protection of the Swiss vineyard industry.

Viticulture in South Africa, A. I. PEROLD (*Internat. Inst. Agr. [Rome], Internat. Rev. Sci. and Pract. Agr., 7 (1916), No. 1, pp. 1–30*).—A descriptive account in which the author discusses the history of viticulture in South Africa, the distribution of vineyards, climatic and soil conditions, culture, vine diseases and insect pests, methods of fertilization, utilization of American stocks and self-bearers, grafting and nursery work, effects of grafting on the quantity and the quality of the grapes and wine, varieties, methods of wine making, viticultural products, the labor question, government aid for promoting the industry, and statistics.

Investigation on the nitrogen nutrition of the olive, L. PETRI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 13 (1916), No. 3, pp. 138–147*).—The author finds that the nitrogen content of flowering branches on which the flowers were fertile averaged from 2.119 to 2.37 per cent of the dry weight, whereas in flowering branches in which the ovaries were abortive the nitrogen content was only 0.72 to 0.924 per cent of the dry weight. The investigation also shows that where there is only a limited quantity of nitrates in a soil poor in organic matter, there is a large development of mycorrhiza. Where nitrates occur in abundance the rapid growth of the rootlets furnish an important check to the infection of mycorrhiza.

The investigation as a whole suggests that nitrogen should be applied to olive trees in a readily available form, both on account of its effect in producing fertile fruit buds and in view of its influence in checking mycorrhiza. If nitrogen is furnished in less available forms the rootlets grow less rapidly and permit of the invasion of fungus growth.

Citrus experimental grove, S. E. COLLISON (*Florida Sta. Rpt. 1915, pp. XCIX–CI*).—In continuation of previous reports (E. S. R., 33, p. 48), measurements are given showing the average gain in diameter of trees from June, 1909, to June, 1915, growing on various fertilizer plats in the citrus experimental grove. The data are accompanied by notes on the condition and treatment of the grove.

Report of plant physiologist, B. F. FLOYD (*Florida Sta. Rpt. 1915, pp. XXXII–XLVIII*).—Experiments to determine the influence of certain sources of ammonia and phosphoric acid upon the growth of grapefruit seedlings grown in sand and in field soil were continued (E. S. R., 33, p. 48). The results from the sand culture experiments described in 1914 are compared with those secured in 1913 and the following conclusions are deduced:

Dried blood is superior to the other sources of ammonia used for producing vegetative growth. When used in combination with dried blood, phosphoric acid from different sources varies the amount of growth but little. In combination with ammonia from mineral sources, however, phosphoric acid from different sources causes a large difference in amount of growth. Basic slag gave the best results as a source of phosphoric acid when used in combination with ammonia from mineral sources. The acid combination (sulphate of ammonia—acid phosphate—high grade sulphate of potash), produced the smallest amount of growth of any of the combinations, but the amount of growth from this combination was largely increased when lime was added. The amount of growth

produced by dried blood + acid phosphate + high grade sulphate of potash was not increased by the addition of lime. The addition of lime alone to the soil produced a growth greater than that produced by the above-named acid combination, but not so large as that produced by this combination plus lime.

The results secured in the field soil experiments conducted in 1915 were not parallel with those secured in 1914, practically all the fertilizer plats in 1915 showing a better growth than the check plats, whereas in 1914 the majority of the fertilizer combinations produced less growth than the check plats. This is attributed largely to the fact that the experiments were conducted at different times of the year. The results for the two years are here presented without discussion. The work is to be continued.

A comparison of some citrus conditions in Florida, Cuba, and California, H. S. FAWCETT (*Mo. Bul. Com. Hort. Cal., 5 (1916), No. 9, pp. 321–337, figs. 10*).—In this article the author briefly discusses some of the differences in horticultural conditions and practices in California, Cuba, and Florida, with special reference to citrus culture.

Citrus trees, T. W. BROWN and L. H. GOUGH (*Cairo: Min. Agr. Egypt, 1915, pp. 19, pls. 4*).—This paper contains instructions for the cultivation and management of citrus trees, together with notes on insect pests found attacking such trees and methods of control.

Report on the work of the Malang Experiment Station for 1915, T. WURTH (*Meded. Proefstat. Malang, No. 12 (1915), pp. 23*).—A progress report on investigations dealing largely with rubber and coffee.

Keeping chestnuts over winter (*Amer. Nut Jour., 5 (1916), No. 4, pp. 43, 52*).—This note describes methods employed by three different nut growers in carrying seed chestnuts through the winter.

Studies in Juglans.—III, (a) Further evidence that the oak-like walnut originates by mutation. (b) A parallel mutation in Juglans hindsii, E. B. BABCOCK (*Univ. Cal. Pubs. Agr. Sci., 2 (1916), No. 3, pp. 71–80, pls. 2*).—In this paper the author presents further evidence to show that the oak-like walnut (*J. californica quercina*) originated as a mutant from *J. californica* rather than as a hybrid between the walnut and oak (E. S. R., 32, pp. 46, 338). A parallel mutation in *J. hindsii* is also discussed.

Drug plant culture in 1916, W. W. STOCKBERGER (*Jour. Amer. Pharm. Assoc., 5 (1916), No. 10, pp. 1068–1075, figs. 5*).—A paper on this subject read before the scientific section of the American Pharmaceutical Association at Atlantic City, in 1916.

Roses for the home, F. L. MULFORD (*U. S. Dept. Agr., Farmers' Bul. 750 (1916), pp. 36, figs. 27*).—A general treatise on rose growing for pleasure and for the beautification of the home grounds. Roses for the lawn, border, arbor, trellis, cutting, and other ornamental purposes are considered with reference to varieties, soil preparation, methods of planting, and training. Consideration is also given to methods of propagation and insect remedies. A section on the fungus diseases of roses, prepared by Flora W. Patterson, is included.

Shade trees, hardy shrubs, roses, perennials, and other ornamental plants recommended for Maine, C. L. WILKINS and S. H. EATON (*Bul. [Maine] Dept. Agr., 15 (1916), No. 3, pp. 33, pl. 1, figs. 6*).—A descriptive list of ornamental plants which the authors have found through years of experience and observations to be adapted to Maine conditions.

Pruning shade trees, H. F. MAJOR (*Missouri Sta. Circ. 81 (1916), pp. 6, figs. 3*).—A popular circular discussing reasons for pruning, pruning with reference to tree structure, and varieties of trees adapted for planting on lawn and street.

Book of garden plans, S. F. Hamblin (*Garden City, N. Y.: Doubleday, Page & Co., 1916, pp. XII+134, pls. 31, figs. 36*).—This work contains twenty blueprint plans with directions and planting lists for each, including photographs illustrating the basic idea. The subjects considered are the farm home of five acres, village home of five acres, planting a small suburban lot, shrub planting for a village home, rose garden, bowlder wall with vines, arbor with vines, small informal garden, poppy bed, naturalistic rock garden, natural rock garden, American wall garden, naturalistic water garden, artificial water garden, woodland garden, wild planting, annual garden, formal garden of Japanese plants, border of fragrant flowers, and special color border. A final chapter gives information on the practical side of gardening, the trees, plants, shrubs, vines, etc., for various conditions, cost estimating, time for planting, and other details.

FORESTRY.

Farm forestry, J. A. Ferguson (*New York: John Wiley & Sons, Inc., 1916, pp. VIII+241, pls. 62, figs. 5*).—This work, which is based largely on the literature of the subject, deals with the care and management and the utilization of the products of the farm woodlot. It has been prepared primarily for use in agricultural colleges and high schools.

County or community working plans as a basis for woodlot extension work, W. D. Sterrett (*Forestry Quart., 14 (1916), No. 3, pp. 467–470*).—In this paper the author outlines a plan whereby both Federal and state forest agencies may cooperate with other public agencies in the development of county or community working plans with reference to woodlot and forest problems.

New topographic survey methods, J. H. and F. R. Bonner (*Forestry Quart., 14 (1916), No. 3, pp. 433–440, pl. 1, figs. 3*).—This paper describes new methods in making topographic surveys as developed largely on the National Forests.

A historical study of forest ecology; its development in the fields of botany and forestry, R. H. Boerker (*Forestry Quart., 14 (1916), No. 3, pp. 380–432*).—This comprises the introductory portion of a series of investigations in forest ecology carried on in 1914–15 by the author at the University of Nebraska. The present paper includes a discussion of the historical development of plant ecology and silviculture, a historical summary of these subjects, and a bibliography of related literature.

Notes on a method of studying current growth per cent, B. A. Chandler (*Forestry Quart., 14 (1916), No. 3, pp. 453–460, figs. 2*).—The method here described in detail consists in determining the diameter for the last five and ten years for each diameter breast high class and producing a curve through these points for the next ten-year period.

The intermittent annual growth of woody plants, A. B. Stout (*Jour. N. Y. Bot. Gard., 17 (1916), No. 201, pp. 147–152, pl. 1*).—A popular discussion of various types of annual growth with special reference to intermittent seasonal growth as observed in our common trees and shrubs.

The botanical and chemical characters of the eucalypts and their correlation.—First report of the committee, H. E. Armstrong et al. (*Rpt. Brit. Assoc. Adv. Sci., 1915, pp. 97–116, pls. 2*).—This comprises summaries of the following investigations conducted with reference to the botany and chemistry of eucalypts on behalf of the British Association for the Advancement of Science: The Botanical and Chemical Characters of the Eucalypts and Their Correlation, by R. T. Baker and H. G. Smith (pp. 97–106); The Development of the Genus Eucalyptus, by R. H. Cambage (pp. 106–108); The Correlation

Between Specific Characters of the Tasmanian and Australian Eucalypts, by R. T. Baker and H. G. Smith (pp. 108, 109); The Cotyledons and Seedling Leaves of the Eucalypts, by C. Hall (pp. 109–113); and Notes on the Evolution of the Genus Eucalyptus, by E. C. Andrews (pp. 113–115). A summary by the investigating committee as a whole is also included. A bibliography of related literature is appended.

Euphorbia tirucalli, G. Scassellati-Sforzolini (*Agr. Colon. [Italy], 10 (1916), Nos. 4, pp. 161–186; 5, pp. 217–234; 6, pp. 284–308, pls. 13, figs. 4*).—A monograph on this latex-yielding species with reference to its botany and distribution, products, and economic utilization.

Manurial experiments with Hevea rubber, R. D. Anstead (*Planters' Chron., 11 (1916), Nos. 12, pp. 132–135; 13, pp. 144–146*).—The results are given of manurial experiments with rubber conducted at the Kerala Estate during the years 1914–15. The results for the two years indicate an increased yield from manure properly applied. It is concluded, however, that the experiment must run for several years to determine whether the increased yield will offset the cost of manuring.

[Tree culture in the sand hills section], J. Cowan (*Nebraska Sta. Bul. 156 (1916), pp. 7, 8, 55–60*).—Some of the more practical results of tree planting experiments conducted at the Valentine Substation are reported, together with suggestions dealing with planting operations, cultural methods, and varieties.

The experiments with trees, which have been conducted since 1911, show that the best quick-growing trees are Norway poplar, cottonwood, and box elder. Of the slower growing deciduous trees the American elm and honey locust have done best. The Russian olive has given fair satisfaction as a lawn tree. Of the conifers bull pines have given the best results. For tree culture in the sand hills country clean cultivation and the preservation of an earth mulch was found to be more essential than watering.

The forestry situation in Virginia, R. C. Jones (*Va. Geol. Com., Off. State Forester, Forestry Leaflet 9 (1916), pp. 8, figs. 7*).—A brief statement relative to the forest situation and important forest problems of Virginia.

The aims of the new state forestry department, R. C. Jones (*Va. Geol. Com., Off. State Forester, Forestry Leaflet 6 (1916), pp. 3–17*).—An outline of the proposed activities of the Virginia state forestry department.

Observations on the woods of the Guindos hacienda, F. Albert (*Bol. Bosques, Pesca i Caza, 3 (1915), No. 1–4, pp. 320, pl. 1, figs. 6*).—This work comprises as a whole observations and data covering some seven years on the forest and woodlands on a large hacienda in Chile. The information given includes a description of the various tracts and the species comprising them, a large number of tree measurements, and conclusions relative to the management of these woods.

Contribution to the distribution of the wild-growing ligneous plants of Switzerland.—III, Distribution of woody species in the Canton of Grisons, P. K. Hager (*Erhebungen über die Verbreitung der wildwachsenden Holzarten in der Schweiz. III, Verbreitung der wildwachsenden Holzarten im Vorderrheintal (Kanton Graubünden). Bern: Schweiz. Dept. Innern, 1916, pp. 331, pls. 6*).—This is the third of a series of studies dealing with the native woody flora of Switzerland, conducted under the direction of the Swiss Inspection of Forests, Hunting, and Fisheries and the Botanical Museum of the Federal Polytechnique School. The present study takes up the ligneous plants of the Canton Grisons.

Part 1 discusses the geography, orography, geology, and climate of the region; part 2 comprises a descriptive catalogue of the woody species; part 3

describes various plant combinations and successions and their aspects; part 4 gives an account of the agricultural conditions in the region; and part 5 reviews the principal results of the investigation with reference to land and plant geography. A number of supplementary charts, together with a bibliography on the subject, is appended.

Report of the division of forestry of the Board of Agriculture and Forestry for the fiscal year ended June 30, 1916, C. S. JUDD (*Hawaii. Forester and Agr., 13 (1916), No. 8, pp. 284–286*).—A concise report covering the operations for the fiscal year ended June 30, 1916, principally along the line of forest protection and forest extension. At the close of the year the total amount of forest lands in the Territory in forest reserves amounted to 798,229 acres.

Notes on state forestry in Ireland, H. R. MACMILLAN (*Forestry Quart., 14 (1916), No. 3, pp. 461–466*).—A popular descriptive account of the organization and activities pertaining to state forestry in Ireland.

Report on the knowledge of forest conditions on the east coast of Sumatra, P. VAN ZON (*Boschbouwk. Tijdschr. Tectona, 9 (1916), Nos. 4, pp. 251–268, pl. 1; 5, pp. 349–374; 6, pp. 429–448, pl. 1*).—An account of forest types, forest management, and lumbering activities on the east coast of Sumatra.

Annual progress report on forest administration in the Western, Eastern, and Kumaun Circles of the United Provinces for the forest year 1914–15, P. H. CLUTTERBUCK, H. G. BILLSON, and F. F. R. CHANNER (*Ann. Rpt. Forest Admin. West., East., and Kumaun Circles [India], 1914–15, pp. 71+LXVII+7*).—The usual progress report relative to the constitution, management, and administration of the state forests in the Western, Eastern, and Kumaun Circles of the United Provinces, including a financial statement for the forest year 1914–15.

All important data relative to forest areas, forest surveys, working plans, forest protection, miscellaneous work, yields in major and minor forest products, revenues, expenditures, etc., are appended in tabular form.

Cost of logging large and small timber, W. W. ASHE (*Forestry Quart., 14 (1916), No. 3, pp. 441–452, figs. 4*).—In this paper data are given to show for several of the different steps of a sawmill operation the comparative cost of handling trees and logs of different sizes, and also to call attention to the field of utility of the results as a factor to be considered in determining the cost of producing lumber and as a potent argument in certain cases in favor of leaving the small trees to grow to a larger size for future cutting. The results here given are recorded merely as preliminary to intensive studies along this line.

Helps in marketing waste, J. T. HARRIS (*Jour. N. Y. State Forestry Assoc., 3 (1916), No. 1, pp. 12–14, fig. 1*).—A popular account of assistance rendered by the Forest Service of the U. S. Department of Agriculture, other forest agencies, and lumber organizations in finding a market for and the utilization of waste material resulting from various wood-using industries.

The preservation of wood, G. DE LA PRAILLE (*Rev. Gén. Chim., 19 (1916), Nos. 1–2, pp. 1–16, figs. 11; 3–4, pp. 41–50*).—A review of the present knowledge relative to methods of preserving wood from decay as developed in different countries.

The preservative treatment of farm timbers, G. M. HUNT (*U. S. Dept. Agr., Farmers' Bul. 744 (1916), pp. 32, figs. 17*).—This publication supersedes Farmers' Bulletin 387, previously noted (E. S. R., 22, p. 740), the subject matter having been revised and brought up to date. It discusses the nature of decay, methods of prolonging the life of posts without the use of preservatives and by means of preservatives, and methods of prolonging the life of other forms of farm timbers.

DISEASES OF PLANTS.

The control of experimental conditions in phytopathological research, A. A. Potter (*Phytopathology, 6 (1916), No. 1, pp. 81–88*).—The author calls attention to the necessity for the improvement of methods of phytopathological research in order that experiments may be more definitely controlled.

Effect of meteorological conditions on development of plant diseases, II, G. N. Dobogin (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 3–5, fig. 1*).—This is the second report (E. S. R., 34, p. 840) on the meteorological conditions in the region of Petrograd in connection with plant diseases. It covers the spring months of 1915.

Report of the assistant plant pathologist, C. D. Sherbakoff (*Florida Sta. Rpt. 1915, pp. XCIV–XCVIII*).—A brief report is given of investigations begun by the author, the principal ones being in connection with seed bed diseases of celery and tomatoes. While a number of diseases of these truck crops are destructive in parts of Florida, the work has been carried on chiefly with damping off. This, the author thinks, is due to several organisms, among them a Rhizoctonia, a Fusarium, a species of Glœosporium, and *Sclerotinia libertiana*. Brief notes are given on the prevailing fungus diseases of a number of vegetables. These include lettuce drop, early blight of celery, Phomopsis of eggplants, Cercospora spots of peppers, cucumber rust, and tomato rust.

Notes on parasitic fungi in Wisconsin, I, II, III, J. J. Davis (*Trans. Wis. Acad. Sci., Arts, and Letters, 18 (1915), pt. 1, pp. 78–109, 251–271*).—The three parts of this contribution are supplemental to a provisional list and give somewhat detailed discussion of a large number of forms. Some of these species are claimed to be new, while others are provisionally so considered. Several species not previously reported for Wisconsin are listed, also additional hosts of these fungi. Alphabetical indexes of hosts are also given.

On fungus parasites of cultivated plants, V. Kazanovskiĭ (*Khozíaistvo, 1915, p. 696; abs. in Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, p. 124*).—It is stated that many Russian varieties of wheat and a minority of introduced ones are attacked by yellow rust.

A survey of plant parasites in 1913 in the Province of Tula, N. P. Trusova (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 35–56*).—During the wet summer of 1913 in the Province of Tula, Russia, the author observed 152 different diseases on cultivated, and 102 on wild, plants. These include many well-known fungus enemies of field and forage crops and of garden, orchard, and forest plants. Several new species are also described.

New species of mycoflora in the Province of Astrakhan, found in 1914, S. Shembel (Szembel) (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 107–112, figs. 10*).—The author gives descriptions of four species which are considered as new and named respectively *Didymosphæria* (*Didymella*) *alhaginis* on *Alhagi camelorum*, supposedly the winter stage of *Septoria alhaginis*, previously reported by the author (E. S. R., 34, p. 842); *Rhabdospora dodartiæ* and *Hendersonia dodartiæ* on *Dodartia orientalis;* and *Cercospora zygophylli* on *Zygophyllum fabago*.

A Gymnosporangium with repeating spores, J. C. Arthur (*Amer. Jour. Bot., 3 (1916), No. 1, pp. 40–45, fig. 1*).—Evidence is presented and discussed regarding the supposed identity of *Uredo nootkatensis* and *Æcidium sorbi*, the name proposed for the new combination being *G. nootkatensis*.

The physiological relation of the powdery mildews to their hosts, G. M. Reed (*Missouri Sta. Bul. 141 (1916), p. 25*).—A brief summary is given of investigations of powdery mildews in relation to their hosts, 22 varieties of wheat having been tested, all but 3 of which gave 100 per cent infection. Two varieties

remained entirely immune, while another gave 75 per cent infection. Most of the varieties tested belonged to the species *Triticum durum* and *T. vulgare*.

The oat mildew was tested on 6 species and varieties of Avena, and with one exception (*A. barbata*), these tests gave 100 per cent infection. Additional tests were made with both the wheat and the oat mildew on varieties studied, with results that confirm previous work (E. S. R., 33, p. 244).

Bacterial blights of barley and certain other cereals, L. R. JONES, A. G. JOHNSON, and C. S. REDDY (*Science, n. ser., 44 (1916), No. 1134, pp. 432, 433; abs. in Phytopathology, 6 (1916), No. 1, p. 98*).—A brief account is given of a bacterial disease of barley which is characterized by water-soaked lesions with a bacterial exudate on the leaf sheaths and glumes. Laboratory and field studies have been made of the organism, which appears to be a species of Pseudomonas.

Similar diseases have been found and studied on wheat, spelt, and rye, and from each of these hosts the causal organism has been isolated and its pathogenicity fully determined. The organisms from these three sources are believed to be all one species which is quite similar to the barley blight organism.

A detailed account of the study of barley blight, together with a technical description of the organism, is expected to appear soon.

Regarding the changes in the chemical composition of rye resulting from the activity of certain Fusarium forms, A. POMASKIĬ (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 77–106*).—Analytical and biological study of the disease of grain known in Russia as "drunk bread" is said to have shown that in the cases under investigation *F. roseum* and *F. subulatum* were present. It is thought that other species may be concerned in this trouble.

F. roseum and *F. subulatum* appear to act similarly on grains, dissolving starch and decomposing albumins. Loss of these substances, and in a less degree of others, totaled in cultures one month old 25.1 per cent. Great changes were also noted in the pentosan, fiber, and fat. There was a decrease of the iodin number and an increase of the acid number. Among the products of the decomposition of the albumins was a toxin, probably a nitrogenous glucosid. Further study is to be made of this toxin and of other products of the action of certain Fusarium forms.

Observations on the pathological morphology of stinking smut of wheat, M. F. BARRUS (*Phytopathology, 6 (1916), No. 1, pp. 21–28, figs. 3*).—An opportunity having been presented to watch the development of plants in experimental plats in reference to control of the stinking smut of wheat, caused by *Tilletia fœtens*, the author made a careful study of the plants from the time they were in bloom until harvest. The symptoms of the various parts of the host as influenced by the parasite are described at length.

Grain smut investigation and control, G. M. REED, EMMA B. MUNDY, and N. M. GIBBS (*Missouri Sta. Bul. 141 (1916), p. 26*).—Continuing previous work (E. S. R., 33, p. 245), experiments were conducted to determine the rate of infection of bunt in wheat, the susceptibility of the various species of oats to loose smut, the relation of early and later planting of oats to the amount of smut, and the effect of temperature, soil conditions, depth of planting, and germination of seed on the amount of smut.

Avena strigosa proved to be the only variety of oats immune in all the experiments, while *A. sterilis* gave the highest percentage of infection. Most of the species of common oats proved susceptible to the loose smut. Late planting, contrary to the belief among plant pathologists, generally resulted in a higher percentage of infection than early planting.

Fungicidal treatment of seed grains, L. MALPEAUX (*Jour. Agr. Prat., n. ser., 29 (1916), No. 5, pp. 98, 99*).—Reporting results of tests made in 1914, the author states that copper sulphate solutions of 0.5 per cent or more as used

for steeping seed grain decreased germinability, the effect increasing with both the concentration and the duration of contact. The loss of germinability of oats was not over 6 to 7 per cent, that of wheat reaching higher figures. On the whole, preference is given to the copper sulphate when used in connection with lime to decrease its harmful effect.

A pathological alteration in the leaves of Agave sisalana, G. Catalano (*Bol. R. Giard. Colon. Palermo, 2 (1916), No. 4, pp. 225–230*).—A brief description is given of a disorder affecting the leaves of *A. sisalana*, causing discolorations and excrescences. No parasite was found in connection with the trouble, which is thought to be related to climatic, soil, and other conditions.

Violet root rot of alfalfa in Virginia, F. D. Fromme (*Phytopathology, 6 (1916), No. 1, p. 90*).—Attention is called to the presence in Virginia of the root rot of alfalfa due to *Rhizoctonia crocorum* (*R. violacea*). This disease was first noted in a single field in Virginia (E. S. R., 33, p. 544), but this, together with the present record, is said to extend materially the known distribution of the fungus in the United States, as it had not been definitely reported previously from the Atlantic States.

Note on the white spot of alfalfa, C. H. Crabill (*Phytopathology, 6 (1916), No. 1, pp. 91–93, figs. 2*).—The occurrence of white spot disease of alfalfa leaves in Virginia is noted. This disease is characterized by rectangular, whitish-translucent spots on the leaves. Affected plants are usually unthrifty and make a poor growth, and it is considered probable that most of them soon die. Upon examination of the root system of the affected plants the upper surface of the crown was always found in a state of decay, and from the diseased tissue was isolated a species of Fusarium and one of Acrostalagmus.

The fact that the crowns of plants affected with white spot always show injury while those unaffected do not has led to the conclusion that crown injury is responsible for these spots.

Melanose of celery, G. N. Dorogin (*Mat. Mikol. i Fitopatol. Ross., 1 (1915), No. 4, pp. 57–76, figs. 9*).—The author states that celery in Russia is attacked by *Septoria petroselini apii*, also by a species claimed not to have been known previously and here described as *S. apii graveolentis* n. sp. The latter is said to cause even more trouble than the former. Both may be found on the same plant. A critical review is given of the species of this group so far as previously reported.

Remedial measures suggested for both diseases include careful selection of seed, treatment of seed with formalin (1:300 for two hours), rejection of plants showing brown spots on cotyledons or leaves, destruction of all diseased material left after harvesting, and deep fall spading of diseased beds.

Cotton wilt in Georgia, A. C. Lewis (*Ga. Bd. Ent. Bul. 40 (1915), pp. 18, pls. 8*).—Noting publications previously issued on cotton wilt in Georgia, the author gives some of the results secured in this work to date by the Georgia State Board of Entomology, in cooperation with the Bureau of Plant Industry of the U. S. Department of Agriculture.

The fungus of cotton wilt attacks only cotton and okra, though it has been known to survive a ten-year rotation. The employment of rotation, though evidently advantageous, is rendered less effective by the large number of plants, both cultivated and wild, that are attacked by *Heterodera radicicola*. This disadvantage may now be largely met, it is claimed, by use of the Iron variety of cowpea, which is very resistant to nematodes.

It is stated that among the several more or less resistant strains recently developed in this State, wilt-resistant cotton has been obtained within the last five years that is sufficiently early to be grown with profit under the boll-weevil conditions which are expected soon to extend throughout this region.

A disease of cold frame parsley caused by Sclerotinia libertiana, J. A. McClintock (*Virginia Truck Sta. Bul. 18 (1916), pp. 379–384, figs. 3*).—A description is given of a disease of parsley due to *S. libertiana*, with suggestions for its control. The conditions under which parsley is grown for winter markets in cold frames are said to favor the rapid development and spread of the fungus, the plants being started in the open and covered with cold frames that are difficult of ventilation during the freezing weather.

As a result of the observations reported, ventilation of the frames is deemed beneficial in preventing the spread of the disease. Removing diseased plants and drenching the soil with a 40 per cent solution of formaldehyde and sterilizing the soil with steam are also recommended, the latter method destroying the organisms occupying the soil.

A bacterial stem blight of field and garden peas, W. G. Sackett (*Colorado Sta. Bul. 218 (1916), pp. 3–43, pls. 3, figs. 3*).—A description is given of bacterial stem blight of field and garden peas that is said to occur generally throughout the San Luis Valley and northern Colorado and to a limited extent in Nebraska, South Dakota, and Utah. The disease is characterized by the watery, olive-brown color of the stems, and by the yellowish, bruised, and watery looking stipules and leaflets. Where a severe outbreak occurs when the plants are young, the stand may be reduced one-third or more.

This blight is said to be caused by *Pseudomonas pisi* n. sp., a technical description of which is given. The organism enters the tissue through the stomata and through wounds produced by mechanical injury, and is pathogenic to field and garden peas, but not to alfalfa, yellow sweet clover, crimson clover, mammoth clover, cowpeas, and garden beans. In the progress of this investigation, varying resistance to attack was noted, and the author states that planting resistant varieties offers the most satisfactory remedy for this trouble, although later planting than usual may somewhat reduce the amount of injury.

Control of the powdery dry rot of western potatoes caused by Fusarium trichothecioides, O. A. Pratt (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 21, pp. 817–831, pl. 1*).—The results of an investigation of the powdery dry rot of potatoes are given, the work having been carried on partly in Idaho. Powdery dry rot, due to *F. trichothecioides*, is said to be the most important storage rot infecting potatoes in the irrigated West. Under ordinary western field conditions, the fungus does not attack the growing potato plant, and potatoes in storage are only attacked through bruises. Planting infected seed potatoes was found to reduce the stand greatly, although a slight amount of infection in the seed pieces did not cause any serious loss. The causal organism is believed to be well distributed throughout western desert soils. It does not develop below a temperature of 2° C. (35° F.), and in dry, well ventilated storage houses, loss would be very slight at temperatures of from 2 to 4°.

When it is necessary to store potatoes in poorly cooled or improperly ventilated storage houses, the disease may be effectively checked by disinfecting the stock, within 24 hours after digging, with a solution of corrosive sublimate or formaldehyde.

Infection of timothy by Puccinia graminis, E. C. Stakman and F. J. Piemeisel (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 21, pp. 813–816*).—In a communication from the Minnesota Experiment Station, the authors report having found it possible by means of artificial inoculations to infect various strains of timothy with *P. graminis avenæ*. This host is said to exert an appreciable effect on the morphology of the spores of the fungus, reducing them considerably in size. The rust develops subnormally on timothy and the pustules always remain small. These facts are believed to be suggestive as to

the possible origin of *P. phleipratensis*, which is considered as being probably a biological species.

Treatment of apple canker diseases, J. C. WHITTEN (*Missouri Sta. Bul. 141* (*1916*), *pp. 33, 34*).—A brief account is given of experiments for the control of apple canker disease. The diseased tissue was cut out until a rim of healthy tissue was reached, and the area disinfected or treated with mercuric chlorid, copper sulphate, iron sulphate, and paint.

The mercuric chlorid treatment proved the most efficient. It is claimed that canker can be largely eradicated from resistant varieties if treatment is given before a large area is involved. When once the disease has become deep-seated in susceptible varieties, the treatment will not stop it.

Stippen and spray injury, C. H. CRABILL and H. E. THOMAS (*Phytopathology, 6* (*1916*), *No. 1, pp. 51–54*).—Attention is called to the various agents that have been regarded as causing apple fruit spot, or stippen. Among those mentioned are physiological disturbances, various pathogenic fungi, spray injury, mechanical injury, etc.

As a result of the authors' investigations, it is claimed that stippen, or stippen-like spots, that is, depressed, highly colored areas underlaid by a corky mass of dead, brown cells, may be produced in several ways, as by bruising, insect puncture, injected poisons, insufficient water, or any other agent which may kill a few cells before the apple is full grown. The authors consider that the disease is not caused by spray materials as they are commonly applied.

The Phytophthora rot of apples, H. H. WHETZEL and J. ROSENBAUM (*Phytopathology, 6* (*1916*), *No. 1, pp. 89, 90*).—The authors report the presence on Oldenburg apples, in July, 1915, of peculiar brown lesions. A Phytophthora was isolated from these, which, on comparison, is believed to be *P. cactorum*. During October and November the same fungus was again isolated from apples purchased in the market of Ithaca, N. Y. While some investigators in Europe have considered the fungus as quite destructive, the authors do not think that it will occasion much injury in this country.

New or noteworthy facts concerning apple rust, N. J. GIDDINGS and A. BERG (*Phytopathology, 6* (*1916*), *No. 1, pp. 79, 80*).—In continuation of investigations (E. S. R., 35, p. 49), the authors present some of the more important facts brought out in connection with the work on the apple rust fungus (*Gymnosporangium juniperi-virginianæ*).

In addition to other statements, the authors claim that a severe infection of the apple rust fungus may cause a premature loss of foliage, a decrease in size of the fruit, and a diminution in the vigor of the tree. As a means of control, the destruction of all cedar trees within a radius of ½ mile around apple orchards has been recommended, but from the authors' observations it is now claimed that this should be done within a radius of 1 mile.

Some new facts concerning fire blight, F. D. HEALD (*Better Fruit, 10* (*1916*), *Nos. 11, pp. 21, 22; 12, pp. 23–25; Rpt. Wash. State Hort. Assoc., 12* (*1915*), *pp. 31–35, fig. 1*).—In amplification of a statement (E. S. R., 34, p. 647) regarding new phases of attack by *Bacillus amylovorus*, the cause of blossom, twig, fruit, and body blight of malaceous fruit trees, the author describes fire blight of a characteristic type on developing fruits of apple.

This type differs from that due to invasion of the fruit by way of the pedicel (in which the whole fruit is destroyed) inasmuch as the localized, dark, depressed, and sometimes red-bordered lesions do not always extend their area, even under most favorable circumstances. Culture studies showed that many of the bacteria were dead in these fruit spots. While insect punctures doubtless afford entrance in some cases, in others invasions of stomata or lenticels may

have occurred. The important new fact considered as established is the occurrence of leaf lesions, the evidence so far as obtained apparently favoring the view that the epidermis is penetrated by the bacteria.

A study of the brown rot fungus in northern Vermont, H. E. BARTRAM (*Phytopathology, 6 (1916), No. 1, pp. 71–78*).—As a result of a study of the common brown rot of stone fruits as found in Vermont, the author claims that the fungus causing the disease is that known in Europe as *Sclerotinia cinerea*. He arrived at this conclusion not only by measurements of the conidia, absence of disjunctors, and the gray color of the conidial tufts, but more especially by the persistent vitality of the conidia through the winter. The conidia, both those already present as well as those produced from the dormant mycelium in mummied fruits, are said to present a danger of early spring infections that has not been generally recognized.

Gummosis in the fruit of the almond and the peach almond as a process of normal life, M. W. BEIJERINCK (*K. Akad. Wetensch. Amsterdam, Versl. Wis en Natuurk. Afdeel., 23 (1914), pt. 1, pp. 531–542, pls. 2; also in ditto, Proc. Sect. Sci., 17 (1914), pt. 1, pp. 810–821, figs. 3*).—Studies previously reported by the author with Rant (E. S. R., 17, p. 1146), and by the latter (E. S. R., 19, p. 449), have been followed up by the author, who states that mechanical wounds in growing tissues of Amygdalaceæ are sometimes healed directly, sometimes after developing gummosis.

The chief tissue which is transformed into gum is the young undifferentiated secondary wood. A network of gum canals forms around the wound as a result of stimulus. The network in the large branches is elliptical in outline, the wound being at the lower focus. If the wound is healed the cambium continues to produce normal secondary wood. Continued stimulus continues gum formation. The stimulus spreads from cells dying slowly after being wounded, poisoned, or parasitized, a cytolytic agent passing therefrom into young wood or procambium which may retain this substance and liquefy. It is considered that gummosis is caused by necrobiosis. Young medullary rays and phloem bundles are converted less readily. In the fleshy part of the fruit the gum arises from the conversion of the phloem, the protophloem remaining unchanged.

It is held that although gummosis in these fruits is a part of the normal development, a wound stimulus is nevertheless active as a normal factor. This arises from the tension in the parenchyma of the fruit wall leading to tearing, necrobiosis, and gum formation in the delicate tissue of the phloem bundles. In one view the almond and the peach almond may be considered as pathological species.

Report of the plant pathologist, H. E. STEVENS (*Florida Sta. Rpt. 1915, pp. LXXVII–XCIII, figs. 2*).—The work here reported covers some investigations of citrus diseases and a pecan disease. The citrus disease investigations have been principally on citrus canker, gummosis, and melanose, the major part of the work having been confined to citrus canker.

In continuation of an investigation of gummosis, inoculation experiments with different organisms have been undertaken, but from six series of these experiments negative results have been obtained. There appears to be some evidence that the disease spreads in the grove under natural conditions. Some experiments for control of gummosis are briefly reported upon, in which the value of Bordeaux paste, lime and sulphur paste, and commercial lime-sulphur solutions were tested, the diseased areas being scraped and covered with the disinfectant, or completely cut out and painted over with it. The results from the treatment, while somewhat favorable, are considered to be only tentative and are to be repeated.

Pruning experiments for control of melanose have been continued, and where the trees were carefully pruned a higher percentage of first-class fruit was obtained.

In connection with the investigations of citrus canker, the author refers to a previous publication (E. S. R., 32, p. 345) in which it is stated that the cause of this trouble is a fungus belonging to the genus Phyllosticta. Subsequent to that publication, inoculation experiments gave negative results, while suspensions of a mixture of this fungus with bacteria isolated from cankered spots produced the disease. This led to the belief that the disease is due to bacteria, and this was soon after shown by Miss Hasse (E. S. R., 33, p. 149). The constant association of the fungus with the canker is not readily explained, but the author believes it may be a secondary agent in the enlargement of the spots. The investigations now in progress include cultural reactions of the organism, *Pseudomonas citri*, its relation to the host plant, and its ultimate effect on the citrus tree.

Brief notes are given on the stem end rot, citrus scab, and withertip of citrus trees.

A study of the pecan disease was begun on account of the serious injury reported from various localities of the State. This disease was previously noted (E. S. R., 23, p. 446) and the name dieback given it on account of the death of the twigs and limbs of the trees attacked. The disease has been studied in the field and the laboratory, and specimens usually show the presence of a number of fungi. One of these has been identified as *Botryosphæria berengeriana*, which seems to be quite constantly associated with the disease, and inoculation experiments with the fungus have produced characteristic symptoms in most instances. Experiments for the control of this disease are in progress, cutting out diseased parts and applying Bordeaux mixture or lime sulphur solution being tested.

Some bark diseases of citrus trees in Florida, J. G. Grossenbacher (*Phytopathology, 6 (1916), No. 1, pp. 29–50, figs. 9*).—A description is given of a number of diseases of citrus trees, together with suggestions for their treatment. Among those described are gummosis, foot rot, crown rot, dieback, withertip, and canker.

The cause of coconut bud rot, J. R. Johnston (*Estac. Expt. Agron. Cuba Bol. 27 (1916), pp. 3–101, pls. 15, figs. 6*).—In a further report on the coconut bud rot (E. S. R., 26, p. 649; 33, p. 150), associated with the presence of an organism which appears to be practically identical with *Bacillus coli*, the present apparent range of the disease is said to include many parts of both eastern and western Cuba, western Jamaica with a few cases in the eastern portion, the Cayman Islands, British Honduras, northern and eastern Trinidad, and British Guiana.

Direct inoculation gave positive results both with the organism taken from diseased tissue and with that of animal origin. It is thought that rots of the coconut palm previously ascribed by other writers to other causes may be shown to be due to the same cause as the bud rot.

The various fungicides are ineffectual as remedial agents, but precautionary measures have given good results in most cases.

Fungus diseases of coffee in Porto Rico, G. L. Fawcett (*Porto Rico Sta. Bul. 17 (1916), Spanish ed., pp. 31, pls. 8*).—This is a Spanish edition of the bulletin previously issued (E. S. R., 32, p. 645).

A withertip of fir, F. W. Neger (*Naturw. Ztschr. Forst u. Landw., 14 (1916), No. 3–4, pp. 121–127, figs. 4*).—A withertip of fir is described. It appears to be related to frost injury and to be associated frequently with *Nectria cucurbitula* and more so with *Dermatea eucrita*.

Horse-chestnut anthracnose, R. G. Pierce and C. Hartley (*Phytopathology, 6 (1916), No. 1, p. 93*).—The authors report the presence in 1914 of a species of Colletotrichum on the petioles, midribs, and veins of the leaflets of the horse-chestnut. An ascomycete was later isolated from living leaves showing anthracnose, and the authors are led to believe that the ascomycete and the Colletotrichum are identical and should be referred to *Glomerella cingulata.*

The leaf blotch disease of horse-chestnut, V. B. Stewart (*Phytopathology, 6 (1916), No. 1, pp. 5–19, pls. 3, fig. 1*).—The author gives a description of the leaf blotch disease of horse-chestnut, discussing its etiology and describing the development of the various stages of the fungus, which is provisionally called *Guignardia æsculi* n. comb. As a result of inoculation experiments, *Æsculus hippocastanum* and *E. glabra* were readily infected, but *E. parviflora* was not.

The more economic phases of this leaf spot and its control have been previously noted (E. S. R., 35, p. 154).

Identity of Peridermium montanum with P. acicolum, G. G. Hedgcock (*Phytopathology, 6 (1916), No. 1, pp. 64–67*).—As a result of inoculation experiments with *P. montanum* from *Pinus contorta*, the author was able to produce the Coleosporium stage on *Aster conspicuus.* This is considered proof that *Peridermium montanum* is the æcial stage of *C. solidaginis*, from which it follows that *P. montanum* is identical with *P. acicolum.* The author considers *P. montanum* simply a western form of *P. acicolum.* The fungus is known to occur in five northwestern States and two Provinces of Canada.

Inoculation experiments with Peridermium montanum, J. R. Weir and E. E. Hubert (*Phytopathology, 6 (1916), No. 1, pp. 68–70*).—As a result of field and greenhouse inoculation experiments performed on 3 plants of Aster and 4 of Solidago with æciospores of *P. montanum*, the typical Coleosporium form was obtained. This is said to be the first time that successful inoculations have been reported on species of Solidago.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The technique of forest protection against animals, K. Eckstein (*Die Technik des Forstschutzes gegen Tiere. Berlin: Paul Parey, 1915, 2. rev. ed., pp. VII+254, figs. 54*).—A brief account is first given of the animal enemies of forests and protection from them (pp. 1–18). Following this the work takes up the combating of vertebrate animal pests (pp. 19–80) and of injurious arthropods (pp. 80–243).

The birds of North and Middle America, R. Ridgway (*U. S. Nat. Mus. Bul. 50 (1916), pt. 7, pp. XIII+543, pls. 24*).—This part of the work previously noted (E. S. R., 30, p. 851) deals with the Cuculidæ, Psittacidæ, and Columbidæ.

The small friends of agriculture, J. W. Da Costa (*Os Pequenos Amigos da Agricultura. Sao Paulo: Govt., 1914, pp. 118, figs. 31; rev. in Auk, 32 (1915), No. 4, pp. 518, 519*).—This work treats of the small animals, especially birds, that are of economic value in the State of Sao Paulo, Brazil.

The upper limit of temperature compatible with life in the frog, A. T. Cameron and T. I. Brownlee (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 67–84*).—This is in continuation of the investigations relating to the limits of temperature compatible with life in the frog (E. S. R., 34, p. 751).

"The experiments in air lead to the unexpected conclusion that the highest temperature at which *Rana pipiens* can maintain life indefinitely is about 18° C. (64.4° F.) while a temperature a degree or two higher will prove fatal within a few days. The fatal temperature is to a great extent a function of time, varying from 19 or 20 to 39 or 40° as the time is shortened."

Bibliography of Canadian zoology, 1914, E. M. WALKER (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 307–318*).—This annotated list (E. S. R., 34, p. 651) covers the literature exclusive of entomology.

Bibliography of Canadian entomology for the year 1914, C. J. S. BETHUNE (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 263–278*).—This continuation (E. S. R., 33, p. 553) lists 134 articles.

Report of entomologist, J. R. WATSON (*Florida Sta. Rpt. 1915, pp. XLIX–LXXVI, figs. 7*).—A detailed report is first given of studies of the velvet bean caterpillar (*Anticarsia gemmatilis*), a preliminary account of which has previously been noted (E. S. R., 34, p. 358). Technical descriptions are given of its several stages, including six larval instars.

The moths make their appearance at Gainesville about the middle of August. The larvæ, which become abundant by September 1, feed only on the various species and varieties of the velvet bean (Stizolobium), the kudzu vine, and the horse bean (Canavalia). The eggs, which are placed separately usually on the underside of the leaves or on the tender shoots, hatch in about three days in September. The young caterpillar feeding on the lower surface skeletonizes the leaf by eating all the soft material but leaves the veins intact. After the second instar it consumes the whole leaf except the larger veins and midrib. From three to four weeks are required for the completion of its larval life. The pupa is formed in an earthen cell usually barely beneath the surface of the soil. Ten to eleven days are passed in this stage in September, some 21 days in November, and as high as 47 and 48 days for two individuals that emerged in January.

The species apparently does not winter over even in the central parts of Florida but works northward each summer from south Florida.

Several predacious enemies are mentioned but parasites appear to be of little importance, a single chalcidid having been reared from a hundred pupæ and none from hundreds collected in the field. A disease due to *Botrytis rileyi* nearly exterminated the caterpillars in fields at Gainesville in October, 1914. While the disease appears almost yearly it too often gets started too late to save the velvet beans. The lime-sulphur-lead arsenate spray, previously developed (E. S. R., 33, p. 58), controls the pest when applied in time.

The Florida flower thrips [*Euthrips*] (*Frankliniella tritici projectus*) has been studied by the author. Three years' observations and experiments with deciduous fruit trees show that if sufficiently abundant it will cause the deformation or even the destruction of leaves and fruit, the general character of its injury being similar to that of the pear thrips.

On citrus the addition of tobacco extract (2.7 per cent nicotin) to lime-sulphur being used for citrus scab at the rate of 1 part to 100 of the lime-sulphur resulted in the destruction of at least 90 per cent of thrips in the blossoms. There appeared to be a considerable increase in the fruit on sprayed over unsprayed trees and the sprayed fruit had a more healthy look.

In further notes on the camphor thrips (*Cryptothrips floridensis*) it is stated that the species has been received from Ceylon. *Anthothrips floridensis* is said to have been common during March on the blossoms of some Mexican avocados, most of which they ruined. It attacks the stamens and pistils similar to the flower thrips.

An outbreak of the cottony cushion scale at Key West was controlled by the introduction of the vedalia. Notes are also given on several miscellaneous insects, including the green shield scale (*Pulvinaria psidii*) which severely infested the wild rubber tree (*Ficus* sp.) at Miami in July.

Thirteenth annual report of the state entomologist of Montana, R. A. COOLEY (*Montana Sta. Bul. 109 (1916), pp. 149–161, fig. 1*).—The insect pests of

1915 are briefly discussed and recorded. Some of the more important species, including the army cutworm (*Chorizagrotis auxiliaris*), etc., are next considered more at length.

The amount of damage caused by insects during the year is said to have been the greatest recorded by the state entomologist. Grain pests were especially abundant, the army cutworm alone having destroyed at least 100,000 acres of grain. The spotted fever tick (*Dermacentor venustus*) appeared in eastern Montana in large numbers and a number of cases of spotted fever were reported from that locality for the first time.

Proceedings of the Entomological Society of Nova Scotia, 1915 (*Proc. Ent. Soc. Nova Scotia, 1915, pp. 107, pls. 2, figs. 10*).—Among the papers here presented are the following: Some Hemiptera Attacking the Apple, by W. H. Brittain (pp. 7–47); The Brown-Tail Moth in Nova Scotia, by G. E. Sanders (pp. 47–53); The Apple Maggot in Nova Scotia, by C. A. Good (pp. 54–78); Bud Moths in Nova Scotia (pp. 84–87), Fruit Worms or Apple Worms in Nova Scotia (pp. 87–89), The Codling Moth in Nova Scotia (p. 90), The Cankerworm in Nova Scotia (pp. 91, 92), and The Tussock Moth in Nova Scotia (pp. 93, 94), by G. E. Sanders; Parsnip Webworm (*Depressaria heracliana*), by C. B. Gooderham (pp. 94, 95); *Hydrœcia micacea* as a Garden Pest, by W. H. Brittain (pp. 96, 97); The Oblique Banded Leaf Roller, *Archips rosaceana*, by A. G. Dustan (pp. 100–102); and A Partial List of the Lepidoptera Observed In and About Truro, Nova Scotia, from July 7 to August 4, 1915, by E. C. Allen (pp. 103–107).

The paper by Brittain on apple insects deals at length with the more important aphidids, etc., attacking the apple, namely, the green apple aphis, the rosy apple aphis (*Aphis sorbi*), the woolly apple aphis (*Eriosoma lanigera*), the rose-leaf hopper (*Empoa rosæ*), the black apple leaf hopper (*Idiocerus fitchi*), including details of life history studies, and a number of other pests.

Important insects which may affect the health of men or animals engaged in military operations (*U. S. Dept. Agr., Office Sec. Circ. 61 (1916), pp. 24, figs. 15*).—This consists of brief descriptions of the insects which annoy or affect the health of men or animals engaged in military operations, with information regarding their control, particularly as applied to the Southwest.

A classification of our limnephilid caddice flies, N. Banks (*Canad. Ent., 48 (1916), No. 4, pp. 117–122*).

"White ants" as pests in the United States and methods of preventing their damage, T. E. Snyder (*U. S. Dept. Agr., Farmers' Bul. 759 (1916), pp. 20, figs. 14*).—A popular summary is given of the termites, the nature of their injury, and preventive and remedial measures.

Report on the inoculation of locusts with Coccobacillus acridiorum, J. B. Rorer (*Bul. Dept. Agr. Trinidad and Tobago, 14 (1915), No. 6, pp. 197, 198*).—Inoculation experiments in Trindad with Venezuelan migratory locusts (*Schistocerca paranensis*) and the giant Trinidad locust (*Tropidacris dux*) showed *C. acridiorum* to be virulent for both species and that its virulence can be increased by passage through a series of locusts.

A new species of Heterothrips from eastern United States, J. D. Hood (*Ent. News, 27 (1916), No. 3, pp. 106–108*).

The Rutherglen bug (Nysius vinitor), W. W. Froggatt (*Agr. Gaz. N. S. Wales, 27 (1916), No. 4, pp. 270–272, pl. 1*).—This hemipteran, after having been comparatively harmless for some years, is said to have been one of the most serious pests during 1915–16. It has been reported, on the coast as well as inland, as damaging fruit, field crops, and even flower gardens.

Some 1915 notes on a few common Jassoidea in the central Mississippi Valley States, E. H. Gibson (*Canad. Ent., 48 (1916), No. 5, pp. 177–179*).

[Studies of the body louse (Pediculus vestimenti)] (*Ztschr. Hyg. u. Infektionskrank., 80 (1915), No. 2, pp. 289–322, pl. 1, figs. 3*).—Two papers (1) A Contribution to the Knowledge of the Biology of the Body Louse and Its Control (pp. 289–298) and (2) The Combat of the Body Louse (pp. 299–322) are presented by E. Widman and B. Heymann, respectively.

Control of the velvet bean caterpillar, J. R. Watson (*Florida Sta. Bul. 130 (1916), pp. 49–58, figs. 9*).—The data here presented are substantially noted from another source on page 852.

It is recommended that when early varieties of velvet beans, such as the Chinese, can be grown a strip around the edges of the field be sown with the Florida variety as a trap crop. This crop should be sprayed or dusted with lead arsenate every two weeks during the caterpillar season, and when it is necessary the main crop should be similarly treated.

Life history studies of Cirphis unipuncta, the true army worm, J. J. Davis and A. F. Satterthwait (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 21, pp. 799–812, pl. 1, figs. 2*).—A report of studies of the biology of this commonly injurious and well-known pest conducted at La Fayette, Ind.

Moths of this species, which were first observed on the night of May 13 feeding on the honeydew from insects on white oak, are thought to have been the adults of hibernating larvæ. Observations indicate that at La Fayette three complete generations may occur annually and that in some seasons a partial fourth generation may occur. Technical descriptions are given of its immature stages, including six larval instars. The period passed in the last larval instar was approximately two and one-half times as long as any of the previous instars and the amount of foliage eaten was nearly seven times as much as in the fifth and more than 80 per cent of all the foliage eaten during the entire larval period. It is estimated that with 8,890 corn plants to an acre it would require 21,473 worms to destroy an acre of corn 2 ft. high, or the progeny of but some 40 females.

For 100 individuals recorded the egg stage approximated 6 days, the larval 26, and the pupal stage 21 days. In one instance a larva was observed to molt six times. The largest number of eggs laid by a single female was 254, though examinations showed that the bodies of some females contained more than 800.

Observations on the life history of the army cutworm, Chorizagrotis auxiliaris, R. A. Cooley (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 23, pp. 871–881*).

At the Montana Experiment Station oviposition was observed from September 30 to October 12, but may have commenced some weeks prior to that time. The eggs, which were deposited upon the bare soil, hatched in about nine days indoors but hatching may be delayed by lack of sufficient moisture. The larvæ feed for a variable period in the fall and the winter is passed in a partly grown stage. In the spring they feed until about the first week in April, then enter the ground to pupate. The adults emerge from the latter part of June to the middle of July and live over until fall, the ova developing from food obtained as adults. Thus in Montana the species is single-brooded.

The life history of Gelechia gossypiella from the time of the cotton harvest to the time of cotton sowing, L. Gough (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 4 (1916), pp. 16*).—An account of the pink boll worm based upon studies in Egypt. See also previous notes (E. S. R., 30, p. 755; 32, pp. 152, 449; 33, p. 655).

The nature of the damage done by the pink boll worm (Gelechia gossypiella), L. Gough (*Min. Agr. Egypt, Tech. and Sci. Serv. Bul. 2 (1916), pp. 6*).—This paper relates to the damage caused by the pest above noted.

Aphidoletes meridionalis, an important dipterous enemy of aphids, J. J. Davis (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 23, pp. 883–888, pl. 1, figs. 4*).—This cecidomyiid, first described in 1908, has been found to be of economic importance in at least six Central States through its feeding in the larval stage upon almost any species of aphid available.

The eggs are deposited on foliage among a colony of aphids in clusters of from 1 to 12, or may be deposited upon the dorsum of the aphid itself. Records kept of two females show 116 and 125 eggs to have been deposited. Upon hatching out the larva attacks the nearest aphid. After sucking the body fluids and killing one, it continues to move on to another until full grown. After from 7 to 11 days, which are required for the development of the larva, a loose cocoon is spun, shortly followed by pupation, usually at or near the surface of the ground. The length of the pupal stages varies from 6 to 9 days. Oviposition, which apparently only occurs at night, was observed to continue for a period of 10 days, the length of life of the adult under the same conditions being 14 days. The total length of its life cycle was observed to vary from 15 to 29 days. Hibernation takes place in the larval stage and possibly also as pupæ within the cocoons.

Mosquito control in Panama.—The eradication of malaria and yellow fever in Cuba and Panama, J. A. Le Prince and A. J. Orenstein (*New York and London: G. P. Putnam's Sons, 1916, pp. XVII+335, pls. 58, figs. 20*).—This work, by the chief sanitary inspector of the Isthmian Canal Commission and his assistant, presents a detailed account of the manner in which mosquitoes have been held in check in the Canal Zone. The work is prefaced by a brief introduction by L. O. Howard of the U. S. Department of Agriculture. The first of the two parts deals with the antimalaria campaign (p. 3–228) and the second part with the yellow fever campaign (pp. 229–324). The work includes maps of the Isthmus, showing the completed canal; of Gatun, showing the Anopheles propagation area and houses where stained specimens were recaptured; and of Havana, showing the yellow fever district. A complete index to the subject matter is included.

New species of Asilidæ from southern California, F. R. Cole (*Psyche, 23 (1916), No. 3, pp. 63–69, pls. 3*).

The cabbage maggot, its biology and control, W. J. Schoene (*New York State Sta. Bul. 419 (1916), pp. 99–160, pls. 8, figs. 3*).—This bulletin is based upon observations commenced in 1906 and extending over the eight following seasons. Data relating to its injury and control work with cabbage seedlings grown under cheesecloth and with truck crops have been previously noted (E. S. R., 25, p. 38; 31, p. 352).

This pest appears to be limited to the North, serious injury having rarely been reported south of latitude 45° in this country and latitude 40° in Europe. The winter is passed in the pupal stage, the adults commencing to appear about the time the Windsor cherry blossoms, and continuing to emerge over a period of four or five weeks. Those that appear first are largely from the fall brood of larvæ, but a few originate from the first and second broods of larvæ of the previous summer. When conditions are favorable there are at least three broods and perhaps a partial fourth brood. The eggs, which are deposited on or near succulent cruciferous plants, hatch in from three to five days. The larva, feeding upon the root, matures in from 18 to 20 days and then enters the soil to pupate. The pupal stage may last from 12 to 18 days or be prolonged for an indefinite period of several months, depending upon moisture and temperature conditions, so that it may be one, two, or three brooded. It is thought that oviposition commences within three to five days after the adults emerge. It is

pointed out that the activities of this insect during the autumn when feeding upon turnips and sprouted cabbage have been largely overlooked. The author's studies show that the presence both in the spring and fall of large acreages of succulent cruciferous roots is a condition necessary for the cabbage maggot to occur in great numbers.

The principal enemies are staphylinids of the genus Aleochara, the cynipid parasite *Pseudoeucoila gillettei*, and a mite of the genus Trombidium.

Control measures include screening for the protection of seed beds, tar-paper disks for the protection of early cabbage, the removal of all crop remnants when the cruciferous crops are harvested, and the destruction of cruciferous weeds.

The cabbage maggot and its work, F. H. HALL (*New York State Sta. Bul. 419, popular ed. (1916), pp. 3–8, pls. 2*).—A popular edition of the above.

Studies in flies.—II, Contributions to the study of specific differences in the genus Musca, P. R. AWATI (*Indian Jour. Med. Research, 3 (1916), No. 3, pp. 510–529, pls. 19, figs. 6*).—In this second paper (E. S. R., 35, p. 660), the author presents a comparative study of the genitalia in different forms of calyptrate flies and his conclusions relative to the homologies of the parts in this group.

The life history of Bdellolarynx sanguinolentus, J. L. MITTER (*Indian Jour. Med. Research, 3 (1916), No. 3, pp. 538–540*).—The breeding habits of this fly, here reported, resemble in general those of *Hæmatobia sanguisugens* previously noted (E. S. R., 35 p. 760).

Destruction of the tobacco beetle (Lasioderma serricorne), D. B. MACKIE (*Trop. Agr. [Ceylon], 46 (1916), No. 3, pp. 170, 171*).—This briefly reports tests and calls attention to the advantages of the vacuum method of fumigation.

New species of the family Ipidæ, J. M. SWAINE (*Canad. Ent., 47 (1915), No. 11, pp. 355–369, pls. 2; 48 (1916), No. 6, pp. 181–192, pl. 1*).—The host plants recorded of several of the forms here described as new are as follows: *Ips perroti* from *Pinus resinosa* on Perrot Island, Quebec; *Dryocœtes pseudotsugæ* from Douglas fir at Stanley Park, Vancouver; *Phlœosinus* pini from *Pinus divaricata* in the Riding Mountains, Manitoba; *P. hoppingi* from cedar limbs in California; *P. vandykei* from cedar limbs at Huckleberry Meadow, Cal.; *Hylastes ruber* from bark of dying Douglas fir in British Columbia; *Pityokteines elegans* from *Pinus monticola* in Oregon and California; *Orthotomicus lasiocarpi* from *Abies lasiocarpa* and *Larix americana* in British Columbia and Alberta, respectively; *O. ornatus* from Arizona and Oregon and from *Pinus ponderosa* and *P. jeffreyi* in California; *I. chagnoni* from *Picea canadensis* and *Pinus strobus* from Ontario and Quebec Provinces; and *I. vancouveri* from *P. monticola* on Vancouver Island and in British Columbia.

Apicultural notes, P. NELSON (*Guam Sta. Rpt. 1915, pp. 41–43*).—The year under report is said to have been a very satisfactory one for the beekeeper. A record of production by nineteen colonies located at Yigo showed that 1,680 lbs. of surplus honey were extracted from January to May, or an average 88 lbs. per colony. A colony placed at Santa Rosa in December by dividing increased to four fairly strong colonies by May and produced 224 lbs. of surplus honey, averaging 56 lbs. of honey in addition to the increase of three colonies. The single colony of honeybees introduced from Hawaii in 1907 has thrived so well that there are now thousands of colonies of wild bees in hollow trees throughout the forests, the progeny of this single queen.

A method of removing honey and bees from hollow trees without cutting the tree, which has been practiced by the author with much success, is described. During the previous year he removed nine colonies from trees within a radius of half a mile by this method, one of which produced over 250 lbs. of honey.

Thersilochus conotracheli, a parasite of the plum curculio, R. A. CUSHMAN (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 22, pp. 847–856, pl. 1, figs. 9*).—Observations made at North East, Pa., of the biology of this ichneumonid parasite are reported, together with descriptions of its immature stages. The species was first described in 1871 from New Jersey and is known to occur also in Connecticut, New York, Pennsylvania, Illinois, Missouri, Kansas, and Michigan. During the seasons of 1914 and 1915 it was by far the most abundant and effective parasite of the plum curculio at North East.

It is only know to attack this one host and is single-brooded. The adult reaches maturity as early as August 24 in New York State, but does not leave the cocoon until the following spring, from late May to the middle of June. The female parasite deposits a single egg within the young curculio through the curculio oviposition scar. The maximum period of incubation is thought to be six days. The larva passes most of its life as an internal feeder, but when nearly full-grown leaves the host and becomes temporarily an external feeder. In this stage it passes four molts, the first taking place, as a rule, after the host has constructed its pupal cell, and the other three follow within a period of ten days. Pupation occurs in about four or five days after the construction of the cocoon.

The parasite apparently does not commence to oviposit until some time after the curculio has begun its attack on the fruit, thus does not control the early curculio larvæ. In 1915 its emergence at North East was retarded by the cold, wet season, so that only the latest of the larvæ were attacked, practically all of which were parasitized.

A new genus of Elophidæ from the United States, A. A. GIRAULT (*Ent. News, 27 (1916), No. 4, pp. 152–154*).

A new genus of pteromalid chalcidoid Hymenoptera from North America, A. A. GIRAULT (*Canad. Ent., 48 (1916), No. 7, pp. 246–248*).

Revision of the parasitic hymenopterus insects of the genus Aphycus, with notice of some related genera, P. H. TIMBERLAKE (*Proc. U. S. Nat. Mus., 50 (1916), pp. 561–640, pls. 6*).—Forty-three species of Aphycus are recognized, of which 14 are described as new, namely, *Aphycus maculipennis* reared from *Lecanium corylifex* at Lawrence, Mass.; *A. albicornis* reared from *Pulvinaria* sp., at Ikeda, near Kobi, Japan; *A. schwarzi* collected in the Santa Rita Mountains, Arizona; *A. rileyi* reared from *Lecanium* sp. on Japanese persimmon at Millheim, Tex., from an unknown host on sumach at St. Louis, Mo., from *L. corni* at Ithaca, N. Y., and at Guelph, Ontario, and also collected at Lansing, Mich., and South Kirtland, Ohio; *A. subfasciatus* reared from *L. cerasifex* on elm at Columbus, Kans.; *A. similis* reared from a lecanium on Japanese persimmon at Millheim, Tex.; *A. physokermis* reared from *Physokermes insignicola* at Santa Maria, Cal.; *A. melanostomatus* reared from a lecanium on linden and oak in Denmark and from *L. fuscum* in England; *A. kingi* reared from *Pulvinaria* sp., Lawrence, Mass.; *A. mayri* reared from *L. coryli* in Denmark; *A. rusti* reared from *Pulvinaria* sp., on sweet potato at Sullana, Piura, Peru; *A. claviger* collected at Auckland, New Zealand; *A. eriococci* reared from *Eriococcus howardi* on *Quercus utahensis*, Salt Lake City; and *A. luteolus* reared from *Coccus hesperidum*, *Saissetia oleæ*, and *C. citricola* at various localities in California.

The genus Pseudococcobius is erected, and three species *Pseudococcobius ehrhorni* reared from *Pseudococcus ryani* at San Francisco, Cal., *P. terryi* reared from *Pseudococcus saccharifolii* in Hawaii, and *P. bifasciatus* reared from *Phenacoccus* sp., on an apple tree at Lancaster, N. H., are also described as new.

The genus Bothriocræra is also erected and the type species *B. flavipes* reared from a dactylopiine coccid on Elymus at Kimballs, Utah, described as new.

Pseudaphycus graminicola reared from a dactylopiine coccid on stipa at Las Vegas, N. Mex., and *Elymus condensatus* at Kimballs, Utah; *P. prosopidis* reared from *Pseudococcus prosopidis*, Mesilla, N. Mex.; *P. websteri* reared from *E. virginicus* at Villa Ridge, Ill.; *Acerophagus gutierreziæ* reared from *Pseudococcus gutierreziæ* at Las Cruces, N. Mex.; *A. erii* reared from *Erium lichtensioides* at Salt Lake City, Utah; *Aenasioidea tenuicornis* reared from *Kermes miyasakii* at Akabane, Japan; *A. kermicola* reared from *K. essigii* on *Quercus agrifolia*, Pasadena, Cal., and from *K. galliformis* at Murray, Utah; and the genus Aphycopsis are described as new.

A contribution to a knowledge of Canadian ticks, C. G. Hewitt (*Proc. and Trans. Roy. Soc. Canada, 3. ser., 9 (1915), Sect. IV, pp. 225–239, pls. 4*).—This is a summary of knowledge of the occurrence, hosts, etc., of ticks in Canada in which 14 species and 1 variety are noted. A list of the literature referred to is appended.

Some centipedes and their venom, J. W. Cornwall (*Indian Jour. Med. Research, 3 (1916), No. 3, pp. 541–557, pls. 5*).—"The orifice of the venom duct is oval and lies on the dorsal surface of the venom claw, nearer the greater curvature and at a little distance from the apex. Centipedes possess four distinct pairs of glands with ducts opening near the head, namely, anterior salivary glands, posterior salivary glands, third pair of glands, and venom glands. Centipedes have definite ductless hæmopoietic organs. The toxic action of the venom is relatively low and is a character of secondary importance. The main function of the venom gland is probably to secrete digestive ferments, not to furnish a lethal agent. Extract of the salivary and the third glands contains lysins, which are selective, anticoagulin, diastase, invertase, and proteolytic enzyms."

FOODS—HUMAN NUTRITION.

Diet and dietetic therapeutics, C. A. Ewald and M. Klotz (*Diät und Diätotherapie. Berlin: Urban & Schwarzenberg, 1915, 4. ed., pp. X+470, fig. 1*).—While based on the third edition of Ewald and Munk's Nutrition of Man in Health and Disease (E. S. R., 8, p. 331) and designated in its subtitle as a fourth edition of that book, the present volume differs in many respects from the earlier. The general knowledge of the science of nutrition has progressed so far in the last 20 years that the discussions of the general functions of food and the stages in metabolism are no longer considered necessary in such a handbook for the general practitioner and consequently have been omitted by the authors. Where recent investigations have overthrown or extensively modified formerly accepted conclusions regarding specific subjects, more authoritative work has been substituted for that previously cited, but where recent work has simply confirmed older conclusions the sources utilized in the earlier editions have been retained. The sections dealing with the diet of infants and children both in health and disease are new, having been prepared by Klotz, who has also contributed the present section on milk.

Contributions to human nutrition (*Zent. Einkaufsgesell. Beschränkt. Haftung, Abhandl. 1915, Orig., Nos. 1, pp. 73, figs. 4; 2, pp. 88, pls. 2, figs. 15; 1916, Nos. 3, pp. 78; 6, pp. 94, pls. 4, figs. 5*).—This series of papers, in addition to summarizing data on various phases of human nutrition, reports some investigations carried on by the Central Purchasing Association, Ltd. The titles and authors of the publications follow: The Treatment and Utilization of Frozen Pork, by R. Plank and E. Kallert; Investigations Regarding Energy and Protein Requirements of the Higher Animals and Man, by H. P. Wamser (in which paper an attempt is made to express, by means of mathematical formulæ, the protein and energy requirements of different species, age, sex,

and activity); Preserved Meat and Preserved Sausage for the Nutrition of the Army and the Nation, by P. Koenig; and The Treatment and Utilization of Frozen Beef, by R. Plank and E. Kallert.

Circulars on human nutrition (*Zent. Einkaufsgesell. Beschrankt. Haftung, Flugschr. [1915], Orig., Nos. 2, pp. 15; 8, pp. 23; 9, pp. 16; 11, pp. 20, figs. 4; 12, pp. 16; 13, pp. 12; 14, pp. 32; 15, pp. 16; 23, pp. 32, figs. 26; 25, pp. 40*).—This series of short popular articles deals with the economical use of food in the home. The titles and their authors follow: The Protein Supply of the German Empire, by H. P. Wamser; Sea Mussels as Food [*Mytilus edulis* and *Mya arenaria*], by Ehrenbaum and F. Duge; Cookery with Little Fat, by Hedwig Heyl and N. Zuntz; Winter Vegetables as Human Food, by K. Weinhausen, Wilhelmine Tschernoglasow, and M. Rubner; Potato Cookery in Wartime, by Josephine Nagel and E. Abderhalden; Christmas Baking in Wartime; Short Contributions to Human Nutrition (collected articles from *Kriegskost*); Cured Fish as Human Food and its Utilization in Minced and Sausage Form, by C. Kallert and Johanna Martin; Our Wild Plants in Cookery, by R. Winckel; and War Cookery in the Summer of 1916.—Recipes for Rations Poor in Meat and Fat, by Josephine Nagel and C. Oppenheimer.

The shortage in the fat supply, its cause, and means of remedy, E. MAUREL (*Rev. Hyg. et Pol. Sanit., 38 (1916), No. 7, pp. 642–672*).—The author discusses the fat requirements of France, the sources of supply, the causes of the diminution of production and increase in cost, and appropriate measures for avoiding a deficiency in the supply of fat (thereby avoiding the increase in price). The fat requirements of the individual are placed at 1 gm. per kilogram of body weight; that is, 65 gm. for the average adult. Of this about 35 gm. is eaten as a constituent part of the average food and 30 gm. as added fat. The actual supply of fat in the Republic is held to be quite sufficient for the needs of the inhabitants.

Bacteriological analysis of oysters sold at Marseille, A. GIGON and C. RICHET, JR. (*Rev. Hyg. et Pol. Sanit., 38 (1916), No. 7, pp. 621–641, fig. 1*).—Bacteriological examination of the oysters sold in Marseille showed them to be badly contaminated. High bacterial contents, with a large percentage of *Bacillus coli*, were found in the case of the shell liquor and the intestinal mass. The organisms of typhoid and paratyphoid A and B were also isolated. The waters from which the oysters were taken and those in which they were floated were badly polluted with sewage. Recommendations are formulated for improving the sanitary quality of the oysters.

Milling and baking, L. AMMANN (*Meunerie et Boulangerie. Paris: J. B.* book of milling and baking. Information is given regarding the different varieties of wheat and their composition and food value. The methods employed and the apparatus used in cleaning and milling wheat are described in detail. Information is also given regarding the preparation of doughs and baking.

Making light bread, ADDIE D. ROOT (*Univ. Missouri, Col. Agr. Ext. Serv. Circ. 11 (1916), pp. 11*).—A popular bulletin which gives information regarding the ingredients used and their proportions, the handling of the ingredients, and bread diseases.

Rice, as prepared for food in Bengal, J. N. RAKSHIT (*Agri. Jour. India, 11 (1916), No. 2, pp. 174–198*).—This article describes in detail the method of preparation, properties, and uses of a number of native dishes prepared from both the unhusked and husked rice.

Breakfast foods and their relative value, G. E. YOUNGBURG (*South Dakota Sta. Bul. 168 (1916), pp. 447–461*).—Analytical and cost data are given regarding a number of breakfast foods sold in the State. The retail price per pound

varied from 7.2 to 43.9 cents. It is stated that with care in selection a saving of from 30 to 100 per cent may be made. The nutritive value per pound of the different foods did not vary materially.

Sanitary studies of baking powders.—Is aluminum absorbable from bread, and similar food products, made with alum baking powder? W. J. Gies (*Biochem. Bul., 5 (1916), No. 20–21, pp. 151–157*).—The author refers to the apparent disagreement in the results of previous work by himself and colleagues (E. S. R., 26, p. 564) on the effect of aluminum salts and the findings of the Referee Board of Consulting Scientific Experts of the U. S. Department of Agriculture on the question of alum in baking powder (E. S. R., 31, p. 556). He presents an outline of a further study of this question, to be carried out with the independent cooperation of other investigators. This is to include a study of analytical methods (noted on page 802 of this issue), an investigation of the facts pertaining to the observation and examination of aluminum salts in the case of human subjects, and a repetition of a portion of his earlier experiments with laboratory animals (dogs).

The bacteriology of the bubble fountain, Dorothy F. Pettibone, F. B. Bogart, and P. F. Clark (*Jour. Bact., 1 (1916), No. 5, pp. 471–480, fig. 1*).—The investigation here reported was made as the result of an epidemic of streptococcus tonsilitis, in which bubble fountains were suspected to be a factor in transmitting the disease. The city water was found to be free from streptococci.

"A survey of all the fountains of the University [of Wisconsin] showed the presence of streptococci in over 50 per cent of the total number. The streptococci varied in abundance from a few chains to an almost pure culture obtained by swabbings from the fountains in the women's dormitory.

"In an experimental bubble fountain, *Bacillus prodigiosus* when introduced either by means of a pipette or by the moistened lips remained in the water from 2 to 135 minutes, depending partly on the height of the 'bubble.'

"Most of the organisms are flushed away, but some remain, dancing in the column much as a ball dances on the garden fountain, even though the bubble be increased to the impractical height of 4 in.

"To avoid the difficulty always present in the vertical column, a simple fountain with a tube at an angle of 50 degrees from the vertical was constructed. *B. prodigiosus* was never found in the plates from this type of fountain, even when samples were taken immediately after the introduction of the organism. . . . [It is believed] that this type of fountain should be generally adopted. Its simplicity, low cost of construction, and freedom from lurking danger should recommend it to all."

Court decision pertaining to the public health [including foods] (*Pub. Health Rpts. [U. S.], Reprint 342 (1913–1916), pp. XXV+192*).—This is a compilation of judicial opinions which have been published in public health reports between May 30, 1913, and July 14, 1916. Several of these opinions have to do with pure-food laws and food sanitation.

Report of the Bureau of Markets of the City of Newton, Mass. (*Rpt. Bur. Markets [Newton, Mass.], 1915, pp. 56, pls. 2, figs. 10*).—In addition to presenting a review of the work of the bureau for the three months ended December 31, 1915, this report discusses the underlying causes of high food costs and gives a comparison of prices of produce sold in the public markets and in the retail stores of Newton and in other places.

Retail prices of food supplies in New Jersey (*Ann. Rpt. Bur. Indus. Statis. N. J., 38 (1915), pp. 149–157*).—This is a compilation of the retail prices of a selected list of food supplies prevailing during the month of June, 1915, as reported by representative dealers in the principal centers of population of the State.

Cost of food for an adult woman, Miss C. E. Collet (*Jour. Roy. Statis. Soc., 79 (1916), No. 3, pp. 300–308*).—The data presented in this paper show the average cost of food per person per week in households of adult women (in all of which some one was especially in charge of the housekeeping) and for adult wage-earning women having no one at home in charge of the housekeeping. The paper is followed by a discussion.

The cold school lunch, Bab Bell (*Univ. Missouri, Col. Agr. Ext. Serv. Circ. 10 (1916), pp. 8, figs. 3*).—Suggestions are given for the choice of foods, the selection of the container, and the packing of the lunch.

Restricted diet and nutritional deficiency, E. Weill, G. Mouriquand, and P. Michel (*Compt. Rend. Soc. Biol. [Paris], 79 (1916), Nos. 2, pp. 37–39; 5, pp. 189–199; 9, pp. 382–386*).—The authors state that the term "restricted diet" may have different meanings, some restricted diets permitting of normal nutrition while others result in illness and, in some cases, in death. In their opinion deficiency diseases are due to depriving the food of some essential substances (vitamins) either by removing the outer coats of cereals or by sterilization of the food.

Experiments with laboratory animals (cats) are reported which showed that diets of raw, frozen, or salted meat did not produce symptoms of nervous degeneration due to deficiency of the diet. Cats fed exclusively upon sterilized meat showed symptoms similar to those produced in pigeons fed upon exclusive diets of cereals which had been sterilized or those from which the outer layers had been removed.

It is the authors' belief that sterilization in the case of meat or grains removes some ferment which is essential to normal nutrition of the body, especially the nutrition of the nervous system. Pigeons which were fed exclusively upon a diet of raw polished rice showed nervous degeneration due to the dietary deficiency. Sterilization of the grains produced the same effect as a removal of the outer coat, and sterilization of the grains after the removal of the outer coat hastened the appearance of the symptoms in the case of pigeons.

The importance of vitamins in relation to nutrition in health and disease, C. Voegetlin (*Jour. Wash. Acad. Sci., 6 (1916), No. 16, pp. 575–595*).—In this lecture the author outlines briefly recent advances in the science of nutrition, especially with reference to the importance of the presence in the diet of small quantities of substances essential for the maintenance of health. The subjects considered are the deficiency disease, beri-beri; the isolation and chemical properties of vitamins; the physiological action of vitamins; and the distribution of vitamins in foods. A discussion of the factors which tend to reduce the vitamin content of the diet is included.

The digestibility and utilization of egg proteins, W. B. Bateman (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 263–291*).—The author reports the results of an extended study of the behavior of egg white in the alimentary tract by means of experiments with laboratory animals (dogs, rats, and rabbits) and human subjects. The data reported may be summarized as follows:

"Raw egg white is found to be a decidedly indigestible substance. It may cause diarrhea in dogs, rats, rabbits, and man when ingested in any large quantity. Its utilization by the body is poor since it is used only to the extent of from 50 to 70 per cent. Subjects can acquire a certain tolerance for the native protein after ingesting it for several days so that it no longer causes diarrhea and is somewhat better utilized."

It was found that raw egg white could be made digestible through coagulation by heat; by precipitation with alcohol, chloroform, and ether; by incubation with dilute acids or alkalis; by partial digestion by pepsin; or by conversion into alkali-metaprotein. The well-cooked whites of from four to

six eggs could be eaten by dogs without the production of any of the symptoms resulting from the ingestion of the raw egg white. About 90 per cent of the nitrogen in cooked eggs was utilized as compared with 50 to 70 per cent in the case of the raw egg white.

"The indigestibility of native egg white probably lies either in its antitryptic content or in its chemical constitution. Its physical texture appears to play a minor part in its behavior.

"Of the individual proteins constituting egg white, the albumin fraction appears to be the indigestible component.

"The whites of the hen's egg and duck's egg act alike in causing diarrhea and in being poorly utilized.

"Egg yolk either raw or cooked is excellently utilized. It sometimes causes digestive disturbances in dogs, apparently because of its high fat content."

The author states that the observations of earlier investigators, relied upon by dietitians in supporting the use of raw eggs, have been misinterpreted and that while raw whole eggs, raw egg white, and albumin water are excessively prescribed in dieto-therapy there is little basis of fact for this practice, in view of the data obtained in this investigation.

An extended bibliography is appended.

Feeding experiments on the substitution of protein by definite mixtures of isolated amino acids, H. H. MITCHELL (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 231–261, figs. 5*).—Experimental data obtained by other investigators on the feeding of mixtures of amino acids to the exclusion of protein are reviewed at length, and the author reports experiments undertaken for the purpose of discovering some mixture of isolated amino acids which would be capable of supporting life. Although the results of these experiments have not been entirely successful, they have several points of interest. The results of the investigation may be summarized as follows:

Mice were kept alive for from 70 to 98 days by feeding alternately a ration containing from 4 to 6 per cent of various mixtures of isolated amino acids, 6 to 4 per cent sucrose, 34 per cent starch, 28 per cent protein-free milk, 10 per cent lard, and 18 per cent butter fat, and a ration containing 10 per cent of sucrose with other constituents in the same proportion as the first. In some of the experiments the mice practically maintained their weight for periods of from 15 to 35 days.

"The alternate feeding of an amino acid ration and a nonnitrogenous ration (except for the nitrogen present in the protein-free milk) induced a better total consumption of food than feeding with an amino acid ration alone, and in all other respects led to more successful results. However, it is probable that in no case was the amino acid intake sufficiently large to assure a fair test of its adequacy.

"Amino acid rations containing no added tyrosin, or no added tyrosin and phenylalanin, did not give appreciably different results from rations containing these amino acids. However, if tryptophane was absent from an amino acid ration the period of survival of mice fed this ration alternately with the nonnitrogenous ration was noticeably shorter than the periods of survival of mice kept on rations containing added trytophane.

"Mice could be kept for much longer periods of time on rations containing mixtures of amino acids, including trytophane and fed alternately with the nonnitrogenous basal ration, than when fed the basal ration alone. Furthermore, this difference in survival can not be accounted for by a difference in energy intake. This fact has been interpreted as meaning that at least some of the amino acids have specific functions in metabolism aside from that of serving simply as material for the synthesis of body protein."

This view is supported by the results of other investigators cited from the literature.

The influence of ingested carbohydrate, protein, and fat on the blood sugar in phlorizin diabetes, F. A. Csonka (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 93–98, fig. 1*).—Following the ingestion of 20 gm. of glucose by phlorizinized laboratory animals (dogs) the blood sugar reached the maximum at the second hour and declined to the original level at the fourth hour. It was found in earlier experiments (E. S. R., 33, p. 755) that 94 per cent of 16 gm. of glucose given to a phlorizinized dog was excreted during the first five hours as "extra glucose."

As the elimination of the ingested glucose was practically complete and the curve of blood sugar was parallel to that of extra glucose, the conclusion is drawn that no glucose was deposited between the periods of absorption and elimination.

"That the blood sugar is increased after ingestion of protein is apparent from the curve which shows that the endogenous glucose derived from meat protein and gelatin appears in the blood as glucose—at least, partially so—since the isoglucogenic quantities of ingested endogenous and exogenous glucose should give the same increase of blood sugar. The ingestion of fat, which does not produce 'extra glucose,' did not cause any appreciable increase in blood sugar."

Studies of urinary and blood nitrogen curves after feeding in the dog, O. H. P. Pepper and J. H. Austin (*Proc. Soc. Expt. Biol. and Med., 12 (1915), No. 8, pp. 179–181*).—The daily variation in the nonprotein blood nitrogen in a normal dog receiving a diet containing 0.4 gm. of nitrogen per kilogram of body weight was about 9 mg. The maximum was reached about 2 hours after feeding, and the original level was reached in about 10 to 14 hours. The feeding of excessive quantities of meat increased the nonprotein blood nitrogen from 25 to 40 mg. in from 6 to 8 hours and the original level was not reached at the end of 24 hours. The curve of nonprotein blood nitrogen in a normal dog after feeding followed closely the curve of the urinary nitrogen.

"In the fasting dog there occurs a gradual fall in blood nitrogen to a minimum of from 12 to 18 mg., reached in from 30 to 48 hours after the last feeding, and followed by a rise in the next few hours to about 25 mg., at about which level it tends to persist. The urinary nitrogen shows a similar but less pronounced curve."

The elimination of ammonia in the urine during rest, D. Liotta (*Arch. Farmacol. Sper. e Sci. Aff., 22 (1916), No. 6, pp. 205–228, figs. 5*).—Experiments are reported with laboratory animals (dogs) and human beings, which show that the elimination of ammonia in the urine increased notably during rest.

The metabolism of sulphur.—I, The relative eliminations of sulphur and nitrogen in the dog in inanition and subsequent feeding, H. B. Lewis (*Jour. Biol. Chem., 26 (1916), No. 1, pp. 61–68*).—The author reviews critically the work of other investigators on the excretion of sulphur as related to nitrogen elimination and reports the results of his own experiments on this subject. In the case of laboratory animals (dogs), determinations were made of the nitrogen and sulphur elimination during periods of prolonged fasting and during subsequent shorter periods of alternate fasting and feeding.

The experimental data showed no evidence of any increasing retention of sulphur as compared with nitrogen. The nitrogen: sulphur ratio during the fasting periods, with two exceptions, varied within narrow limits (from 14 to 15 for the most part).

The author states that if a partial conservation of the protein molecule in cellular catabolism can be effected by the organism, as has been suggested by

other investigators, this does not appear to be effective in the case of the sulphur fraction of the molecule in the light of these experiments. "This conclusion is in accord with the present-day conception of the indispensability of adequate amounts of preformed cystin in the diet, as recently exemplified by the experiments of Osborne and Mendel on white rats."

High nitrogen: sulphur ratios, with a retention of sulphur, were found during the feeding periods following the fasting periods. When the feeding periods extended over a number of days there occurred a gradual diminution of the ratio to normal, but if the feeding period was followed by a fasting period the ratios were lower than the normal or fasting ratios, indicating an excessive elimination of sulphur as compared with nitrogen. On the basis of unpublished experimental data, the author believes that this indicates a retention of sulphur to build up sulphur-rich tissues, as the result of a specific attempt of the organism to restore material lost during the starvation period, rather than a lag in the elimination of sulphur.

ANIMAL PRODUCTION.

Experimental studies on growth, II–VII, T. B. ROBERTSON, L. A. RAY, and ETHEL CUTLER (*Jour. Biol. Chem., 24 (1916), No. 3, pp. 363–408, figs. 14; 25 (1916), No. 3, pp. 635–667, figs. 13*).—In continuation of work already noted (E. S. R., 35, p. 65), six papers are here presented on the influence of protein dietary factors upon the process of growth and phenomena incident thereto in white mice.

II. *The normal growth of the white mouse* (pp. 363–383).—In these studies it was found that "in each sex there are three separate extra-uterine growth cycles. The first cycle attains its maximum velocity at some time shortly prior to 7 days after birth and culminates at 14 days. The second cycle attains its maximum velocity at from 21 to 23 days and culminates soon after the twenty-eighth day. The third cycle attains its maximum velocity at about 6 weeks and thereafter decreases in velocity continuously but very slowly, so that growth of the animals still occurs between the fiftieth and sixtieth weeks succeeding birth.

"All the cycles are less extensive in the female than in the male.

"The variability in weight of the animals shows a decided tendency to increase with increasing velocity of growth and to decrease with decreasing velocity of growth. After the fortieth week, however, especially in the females, there is a tendency of the variability to increase progressively without any corresponding increase in the rate of growth.

"Weaning of the animals on the twenty-first day after birth produces no physiological disturbance whatever in the young.

"It is shown from the variability of the weight that considerable numbers of animals must be employed to obtain reliable data in experiments upon growth. The weight data reported in this and succeeding articles are probably within 1 or 2 per cent of the true values.

"Birth in mice occurs during the first half of the first growth cycle. The eyes open coincidently with the culmination of the first growth cycle, a complete coat of fur being acquired at the same time. Puberty coincides with the period of maximum velocity of growth due to the third growth cycle.

"The development of the thyroid and of the thymus in mice presents well-marked stages which coincide closely with the cycles displayed in the growth curve of these animals. Subsequent to the culmination of the first-growth cycle the thyroid is heavier in the male than in the female, while the thymus is heavier in the female than in the male.

"There is a steady decrease in the percentage content of alcohol-soluble phosphorus in the tissues (other than cerebral tissues) of mice from birth to 210 days of age, and this decrease is almost exactly in direct proportion to their age."

III. *The influence of the anterior lobe of the pituitary body upon the growth of the white mouse* (pp. 385–396).—It was found that "the administration of 0.125 gm. per day per animal of fresh anterior lobe pituitary tissue to mice, beginning at 4 weeks after birth (conclusion of the second growth cycle) leads to retardation of growth during the earlier portion of the third-growth cycle, between the sixth and twentieth weeks. In the latter part of the third-growth cycle, however, from the twentieth to the sixtieth weeks after birth, the growth of the pituitary-fed animals is markedly accelerated, so that they not only catch up to the normals, but actually, at about one year of age, come to surpass the normals in weight.

"The effect of the pituitary tissue upon the variability of the weight of the animals is similar to its effect upon the velocity of their growth. The variability is diminished in the earlier portion of the third-growth cycle, particularly between the tenth and the twentieth weeks. Between the twentieth and the sixtieth weeks, however, the variability curves of the pituitary-fed animals approach the variability curves of the normals, and at about the fortieth or fiftieth week the two variability curves intersect.

"Pituitary-fed animals, from about the thirtieth week onward, appear more compactly built than normal animals. The pituitary-fed animals, weight for weight, are smaller than the normals of the same age, and size for size they are heavier. Pituitary-fed males are noticeably more belligerent in their habits than normal males."

IV. *The influence of tethelin, the growth-controlling principle of the anterior lobe of the pituitary body, upon the growth of the white mouse* (pp. 397–408).—From the concentrated alcoholic extract of dried anterior lobes of ox pituitaries a substance has been extracted and named tethelin.

"The effects of tethelin upon the growth of white mice resemble in every particular the effects of the administration of the whole anterior lobe. These effects consist in marked retardation of the first portion of the third growth cycle followed by acceleration of the latter portion of the third growth cycle. The variability in weight of the tethelin-fed animals, like that of the pituitary-fed animals, is less than that of normals of the same age. Adult tethelin-fed animals, like adult animals which have been fed upon the anterior lobe of the pituitary body, are more compact in form and build than normal animals of the same age. Weight for weight the tethelin-fed animals are smaller than the normal ones, and size for size they are heavier. The coats of adult male animals which have been fed with tethelin retain, even at 14 months of age, the glossy silky appearance of the coats of young animals. Normal males, even 6 months prior to this age, have shaggy, staring, and discolored coats. This improvement in the coat was not observed in the pituitary-fed animal. Tethelin-fed animals do not display the remarkably enhanced belligerency which is exhibited by pituitary-fed animals."

V. *The influence of cholesterol upon the growth of the white mouse* (pp. 635–646).—It was found in these studies that "the administration of 40 mg. per day per animal of cholesterol to mice, beginning at five weeks after birth (conclusion of the second growth cycle), leads to marked retardation of growth during the earlier portion of the third growth cycle, between the fifth and tenth weeks. From the tenth week onward, however, growth is decidedly accelerated, although the acceleration is insufficient to compensate entirely for the initial retardation. The influence of cholesterol upon the third growth cycle in mice is

therefore comparable with that produced by the administration of much smaller doses of tethelin. The influence of cholesterol upon the variability of the animals to which it is fed is, however, directly opposite to the effect exerted by tethelin, for while tethelin reduces the variability of the animals to which it is fed, cholesterol increases their variability. This increase in variability is mainly attributable to the very unequal acceleration, in different individuals, of the latter portion of the third growth cycle.

"Cholesterol-fed animals do not noticeably differ in build from normal animals. Their coats are smoother and more glossy in appearance than those of normal animals of the same age. Between the fifth and tenth weeks the testicles of cholesterol-fed males become very prominent. This disproportion between the size of the testicles and that of the animals bearing them rapidly disappears subsequent to the tenth week. It is probably due to absence of retardation of the growth of the testicles during the first five weeks of feeding, so that the retardation of the body growth of the animals leads to disproportionate size of the testicles. The subsequent acceleration of the body growth restores the normal proportion.

"No deleterious effects attributable to the feeding of cholesterol were observed. Three animals which were examined after 50, 463, and 511 days of feeding, respectively, showed no evidence of lesions in the wall of the aorta such as are observed in rabbits after feeding relatively smaller doses for comparatively brief periods of time."

VI. *The influence of lecithin upon the growth of the white mouse* (pp. 647–661).—In these studies it was found that "the administration by mouth of 80 mg. per day per animal of egg lecithin, beginning at four weeks after birth (conclusion of the second growth cycle), leads to no deformation of the curve of growth, the only demonstrable effects of the administration consisting in a very slight uniform retardation of growth and a low degree of resistance to infection, both effects being not improbably attributable to the injurious action of excess of cholin absorbed from the alimentary tract.

"The administration by mouth of 4 mg. per day of lecithin derived from the anterior lobe of the pituitary body produces similar effects. Having regard to the comparatively small dose administered it is possible that these effects may in part have been due to admixture of other and more potent substances with lecithin derived from this source, or at all events to a peculiarity of lecithin derived from the anterior lobe of the pituitary body.

"The lack of effect of lecithin administered by mouth in comparison with its effects when administered subcutaneously or to lower organisms is probably attributable to the fact that lecithin is completely split during digestion and is not absorbed to any appreciable extent as such."

VII. *The influence of the administration of egg lecithin and of cholesterol to the mother, upon the growth of suckling mice* (pp. 663–667).—The authors found in these trials that "the administration of 100 mg. of egg lecithin per day by mouth to the mother slightly retards the growth of suckling mice. The administration of 100 mg. of cholesterol per day by mouth to the mother causes a very marked retardation of the growth of suckling mice between the ninth and twenty-first days after birth."

It is not decided "whether these actions represent the direct effect of lecithin and cholesterol upon the growth of sucklings or only an indirect effect due to interference with the supply of milk."

The mechanism of crossing-over, I, II, III, IV, H. J. MÜLLER (*Amer. Nat., 50 (1916), Nos. 592, pp. 193–221, figs. 5; 593, pp. 284–305, figs. 4; 594, pp. 350–366; 595, pp. 421–434, figs. 4*).—The author summarizes the results of his studies as follows:

"Recent results complete the parallelism between factor groups and chromosomes in Drosophila. This strengthens the evidence that separation of linked factors is due to an interchange between chromosomes.

"The chief gaps in the information regarding the total frequency of interchange in the different groups have been filled, and it is found that the usual total frequencies of separation correspond to the lengths of the chromosomes. This constitutes specific evidence that crossing-over is the method of interchange between the chromosomes, and that the frequency of crossing-over between factors is determined by their distance apart in the chromosome. It supplements the other evidence for these conclusions that had previously been found by Sturtevant in the linear manner of linkage of the factors.

"It seems uncertain whether crossing-over occurs in the strepsinema stage, as concluded by Janssens, or earlier in synapsis. The cytological evidence at present at hand would seem insufficient to settle this point. Possible tests for various alternative mechanisms of crossing-over are proposed.

"In order to study the nature of crossing-over by means of 'interference' stocks were made up that differed in regard to many factors. Females heterozygous for 22 pairs of factors were thus obtained, and a special method was devised for testing their output. Other special methods for obtaining multiple stocks and for eliminating discrepancies due to differential viability have also been presented. The results have been arranged in the form of a curve showing the amount of interference for various distances. The results thus far obtained confirm those obtained by less exact methods, and also give evidence that interference decreases gradually with distance from a point of crossing-over; this, taken together with certain evidence from nondisjunction, lends some probability to the view that crossing-over occurs at an early stage in synapsis.

"A case of crossing-over in an embryonic cell of a male is reported.

"Incidentally, the experiments have afforded an extensive test of Castle's assumption of contamination of factors by their allelomorphs. Outcrossing in each generation for 75 generations has failed to change any of the factors."

A bibliography of references is included.

Investigation in Mendelian inheritance, G. LEFEVRE and E. H. RUCKER (*Missouri Sta. Bul. 141 (1916), p. 42*).—A progress report of work in crossing Silver-Spangled Hamburg × Brown Leghorn, and Sebright × Rose-Comb Black Bantam. In the latter cross the F_2 cocks showed three conditions: (1) Male-feathered (SS); (2) hen-feathered (ss); and (3) intermediate condition (Ss).

Total, digestible, and manurial composition and compensation value of foodstuffs, compiled by G. S. ROBERTSON (*Chelmsford, England: East Anglian Inst. Agr. [1916], pp. 25*).—Compiled analyses are given of a large number of feeding stuffs and similar materials.

Studies on the mineral elements in animal nutrition, E. B. FORBES (*Jour. Wash. Acad. Sci., 6 (1916), No. 13, pp. 431–446*).—The author summarizes the results of metabolism experiments conducted at the Ohio Experiment Station and previously reported from various sources.

Inspection of feeding stuffs (*New York State Sta. Bul. 420 (1916), pp. 161–309*).—Analyses of the following feeding stuffs are given: Cotton-seed meal; linseed meal; malt sprouts; distillers' and brewers' dried grains; yeast or vinegar dried grains; corn gluten feed and meal; hominy feed; meat scrap and beef scrap; fish scrap; tankage; bone meal; red dog flour; wheat bran and middlings; rye bran and middlings; buckwheat bran and middlings; barley middlings; corn, pea, coconut, and alfalfa meals, corn oil cake meal, and peanut oil meal; dried beet pulp; oat hulls; and various mixed and proprietary feeds.

The grazing industry of the blue grass region, L. CARRIER (*U. S. Dept. Agr. Bul. 397 (1916), pp. 18, figs. 16*).—This bulletin gives a general review of the

grazing industry of the blue grass regions of Virginia, North Carolina, Tennessee, Kentucky, and West Virginia, the topics dealt with being the different grades of blue grass pastures, effect of winter grazing on the sod, kinds of live stock raised, wintering the steers, getting a sod, value of a pasture when grazed with cattle and with sheep, maintaining the fertility of the soil, the proper rate to graze, care of pastures, and the supply of stockers.

In estimating the value of blue grass pasture when grazed with cattle, data were collected from 22 pastures in Virginia, West Virginia, and Kentucky, averaging 193 acres and 60.4 head of cattle. The average results obtained were as follows: Yearly gain per steer 386 lbs., and per acre, 121 lbs.; gross returns, $12.40 per acre; cost of wintering per steer $12.13, and per acre of pasture, $3.80; and net returns, $8.60 per acre. The acreage of pasture per steer varied from 5.55 to 1.8; the yearly gain per acre from 68 to 222 lbs.; the cost of wintering from $30.83 to $7.50 per steer; and the net returns per acre from $2.10 to $14.08. The values assigned in obtaining these results were 7 cts. per pound as the purchase price of stockers, 8 cts. as the selling price, $4 a ton for silage, 60 cts. a bushel for corn, $12 a ton for hay, $6 a ton for corn stover, and $4 a ton for straw. Taxes, insurance, fencing, and labor of caring for stock were not included.

Data on pasturing sheep on six pastures show that the annual returns per acre of pasture, with wool at 25 cts. per pound and lambs at 7 cts. per pound, varied from $2.90 to $12.66. The author states that the average cost of wintering sheep is about 75 cts. per head.

[Animal husbandry], *Missouri Sta. Bul. 141 (1916), pp. 19–25, figs. 5*).—Notes on the following investigations, continuing work previously noted (E. S. R., 33, p. 265), are presented:

Use of feed experiment, by P. F. Trowbridge, C. R. Moulton, and L. D. Haigh.—In this experiment it was found that heifers grown on a low plane of nutrition seem to produce as well-fleshed calves as those grown on a higher plane of nutrition.

A thrifty yearling steer has a strong tendency to grow. One that gained only 0.5 lb. a day became thinner in flesh. At the end of a year on such a plane of nutrition he had less tendency to grow and an increased tendency to put on fat. A thrifty yearling steer kept at body maintenance weight for a year made a marked skeletal growth and used most of his reserve tissue fat but none of the fat stored in the skeleton. Another such steer continued to grow when made to lose 0.5 lb. a day, but the fat from the skeleton as well as the tissue fat was consumed during a year of such treatment. The composition of a thin 3-year-old steer is given as water 56.4 per cent, protein 18.85, fat 18.59, and ash 5.72; of the first 500 lbs. gain made, water 37.58, protein 11.92, fat 48.56, and ash 1.96; and of the second 500 lbs. gain made, water 17.77, protein 5.15, fat 75.88, and ash 1.5. Measurements indicate that such an animal makes a marked skeletal growth during the period of fattening.

Factors influencing the normal rate of growth in domestic animals and the permanency of the effects of arrested development, by F. B. Mumford and P. F. Trowbridge.—Beef calves are the subject of this experiment, which has been in progress only a short time. It has not been difficult to hold the animals in the low plane of nutrition group to the required rate of growth on a roughage ration of alfalfa hay and oat straw, 3:2.

Age as a factor in animal breeding, by F. B. Mumford and L. A. Weaver.—Observations have been made on 615 pigs of sows of three groups, immature, half-mature, and mature. The pigs from very young mothers are apparently somewhat less vigorous and smaller at birth than the pigs from the older

sows. The first period of lactation in the very young sows exerts a markedly retarding effect on the growth of the mothers. These results confirm last year's work (E. S. R., 33, p. 265).

A study of the residual effects of forage crops for swine, by L. A. Weaver.—The results of this year's trials were the reverse of those obtained last year (E. S. R., 33, p. 266). This year there was found to be a slight advantage in favor of pigs which had previously been in dry lot, as compared with those previously on pasture. From the results of the two years' investigation there is little evidence that hogs fed on forage crops during the summer are more quickly or economically fattened after such treatment than similar hogs fed in a dry lot during the same period.

Forage crops for pork production, by L. A. Weaver.—The results of this experiment indicate that it is not necessary to supplement a corn ration with tankage, or other high protein food, when hogs are on rape pasture. Results of other tests indicate that it is a profitable practice to feed a small amount of tankage to hogs pastured on corn and cowpeas.

Corn silage as a part ration for horses of various ages, by E. A. Trowbridge and E. H. Hughes.—The animals studied included draft horses and mules, saddle mares, draft and saddle foals, 2-year-old fillies, and 3-year-old geldings, divided into pairs. Each animal received the same grain ration consisting of corn, oats, and bran, 2:2:1. One of the animals in each pair of the growing and idle horses received alfalfa hay as its roughage, part of which was fed at night and part in the morning. The other animal in each pair received alfalfa hay in the morning and corn silage at night. The draft animals at work were fed the same except that timothy hay was used instead of alfalfa. Some difficulty was experienced in getting the animals that had been on dry feed previous to the test to eat the silage.

With two exceptions, the animals receiving silage were in a more thrifty condition at the end of the trial. The results of the first test indicate that silage can be successfully substituted for a part of the hay in the ration of horses at the rate of 2 lbs. of silage for 1 lb. of hay.

[Animal husbandry], A. C. Hartenbower and L. B. Barber (*Guam Sta. Rpt. 1915, pp. 15, 16, 22–25, pl. 1*).—The breeding experiments with horses, cattle, pigs, goats, and chickens have been continued along the same lines as heretofore (E. S. R., 32, p. 767). It has been uniformly noted that the station's pure-bred sires bring about a marked improvement in the native live stock even in the first generation, although from the standpoint of hardiness a certain percentage of native blood appears to be desirable. The effect of inbreeding has become strongly noticeable in the station's pigs and chickens, and arrangements have been made for the shipment of pigs, goats, and chickens from the United States to the station. In an effort to improve live stock on the island the station has made arrangements to send breeding sires to different sections.

In a preliminary test of pasture crops for pigs cowpeas proved superior to soy beans. Results indicated that in wet seasons at least two crops of pasture can be secured from one sowing of cowpeas. The cowpeas and soy beans were seeded in December. One-half an acre of Para grass kept six sows and one boar in good flesh throughout most of the extreme dry season. This test showed that Para grass should not be pastured too heavily, and that it should be given rest periods of two out of every five weeks to recuperate.

In a feeding test with pigs a ration of native feeds was compared with a ration of imported feeds. Two lots of 4 Berkshire-native cross-bred pigs were used in the experiment which lasted 64 days. Each lot received 10 lbs. of Para grass daily, and in addition one lot was fed 18 lbs. of breadfruit and 3 lbs. of

grated coconut daily, and the other lot 4 lbs. of corn chop and 4 lbs. of wheat shorts daily. The first lot made an average daily gain of 0.44 lb. per pig at a cost of 10.1 cts. per pound of gain. The second lot made an average daily gain of 0.52 lb. per pig at a cost of 9.5 cts. per pound of gain. Breadfruit was valued at 0.5 ct. per pound, grated coconut at 1 ct. per pound, corn chop at 2.25 cts. per pound, and wheat shorts at 1.75 cts. per pound.

[Calf and pig feeding experiments], J. M. Scott (*Florida Sta. Rpt. 1915, pp. XXI–XXIV*).—Three lots of four grade Jersey heifer calves each were fed 35 days as follows: Lot 1, 4 qt. of whole milk per calf per day; lot 2, 4 qt. of whole milk and 12 oz. of oatmeal per calf per day; lot 3, 8 qt. of whole milk per calf per day. Each lot of calves had 0.1 acre of Dwarf Essex rape pasture. The calves made average daily gains per head of 0.457, 1.04, and 1.65 lbs. for the respective lots.

A pig feeding test with dasheens is noted below.

Pig feeding, J. M. Scott (*Florida Sta. Bul. 131 (1916), pp. 59–69, fig. 1*).—This is a continuation of work previously noted (E. S. R., 28, p. 770).

Two lots of four 75-lb. Berkshire pigs each were fed 46 days, lot 1 receiving shelled corn and green cowpeas, and lot 2, shelled corn and green sorghum. The shelled corn and green feed were fed in equal amounts, and each lot of hogs received the same number of pounds of feed. These pigs made average daily gains per head of 0.43 and 0.36 lb., and consumed per pound of gain 11.7 and 14 lbs. of feed for the respective lots.

Three lots of pigs were fed 43 days as follows: Lot 1, shelled corn; lot 2, shelled corn and peanuts, 3:1; lot 3, shelled corn and peanuts, 1:1. All lots were fed Dwarf Essex rape in addition to the other feeds. These pigs made average daily gains per head of 0.686, 0.72, and 0.774 lb., consuming per pound of gain 4.67, 4.44, and 4.14 lbs. of feed for the respective lots. The hogs that were fed peanuts presented a better appearance than those fed corn and rape only. Their coats were much smoother, and they were more thrifty generally.

Three lots of 5 pigs each were fed 31 days as follows: Lot 1, shelled corn; lot 2, shelled corn and ground velvet beans, 3:1; and lot 3, shelled corn and ground velvet beans, 1:1; all lots being fed Dwarf Essex rape in addition to the other feeds. These pigs made average daily gains per head of 0.31, 0.23, and 0.2 lb., consuming per pound of gain 18.3, 24.5, and 28 lbs. of feed for the respective lots.

Five lots of 4 pigs each were fed 30 days as follows: Lot 1, corn alone; lot 2, corn and cracked velvet beans, 3:1; lot 3, corn and cracked velvet beans, 1:1; lot 4, corn and cracked velvet beans, 1:1, plus iron sulphate; and lot 5, corn and cracked velvet beans, 3:1, plus iron sulphate. The iron sulphate was used in an attempt to improve the velvet-bean ration, since previous results had been unsatisfactory. This salt has been used successfully with cottonseed meal, but results of this test did not indicate that iron sulphate was beneficial in producing gains. These pigs made average daily gains per head of 0.47, 0.63, 0.56, 0.52, and 0.53 lb., consuming per pound of gain 6.35, 4.8, 5.37, 5.74, and 5.62 lbs. of feed for the respective lots.

Four lots of pigs were fed 59 days as follows: Lot 1, shelled corn alone; lot 2, shelled corn and raw dasheens, 1:4; lot 3, shelled corn and raw dasheens, 1:1; and lot 4, shelled corn and dasheens, 1:4, and a small amount of velvet-bean meal. These pigs made average daily gains per head of 0.45, 0.107, 0.38, and 0.187 lb., consuming per pound of gain 6.35, 32.63, 8.2, and 20.04 lbs. of feed for the respective lots.

DAIRY FARMING—DAIRYING.

Factors influencing the development of dairy heifers, C. H. ECKLES and T. C. REED (*Missouri Sta. Bul. 141 (1916), pp. 26, 27*).—Continuing work previously noted (E. S. R., 33, p. 274) efforts are being made to find the protein requirements of growing animals and the normal rate of growth.

One heifer has now been carried from the age of six months to the time of calving at the age twenty-eight months on a ration containing less than 0.5 lb. of digestible protein daily, or about half of that prescribed by the Armsby feeding standard. This amount is apparently below the minimum required, since, although plenty of energy for growth was supplied, the growth of the animal was retarded in both skeleton and tissue development, and her calf was born with rudimentary eyes.

As a control ration with which to regulate the amount of protein and energy as desired and at the same time supply a complete protein, skim milk powder as a source of protein, a small amount of timothy hay for roughage, and a mixture of starch and sugar to supply the energy have been found satisfactory. Mineral matter is added in the form of bone meal and citrates of potassium and magnesium. A heifer on a ration made up in this manner has shown practically normal growth for seven months with a protein consumption of approximately 0.75 lb. per day.

In a preliminary study of the normal rate of growth of dairy heifers it appears that under normal conditions the curve of the growth is very similar for each individual animal. If one animal is below the average in the beginning it is generally about the same distance below the normal during the growing period. Pregnancy exerts but little effect upon the curve of growth, but lactation results in a decided check to growth. A low mineral content of the ration does not show any appreciable effect upon the rate of growth. A ration containing less than half the protein called for by Armsby's standard for growing animals resulted in the animal making 73 per cent of normal growth in height and 54 per cent of normal growth in weight.

Feeding cotton-seed meal and hulls to dairy cows, J. S. MOORE (*Mississippi Sta. Bul. 174 (1914), pp. 1–10*).—In an experiment which lasted over six years, 9 cows in their first lactation period were divided into three lots of 3 cows each; later on 2 heifers were added to each lot. Lot 1 received a heavy ration of cotton-seed meal with little other grain feed and no cotton-seed hulls for roughage; lot 2 received a heavy ration of cotton-seed hulls with no cotton-seed meal; and lot 3 received no cotton-seed products. During the greater part of the first period (180 weeks) the cows were fed the maximum amounts of cotton-seed meal and cotton-seed hulls, and during the second period (144 weeks) they were fed these amounts only when giving a fair yield of milk and when pasture was not available. As a rule, during the second period little cotton-seed meal was fed for 30 days before calving and no cotton-seed meal for a time after calving.

The cows in lot 1 were bred 56 times and dropped 22 calves, with an average of 14 months between calvings; the cows in lot 2 were bred 41 times and dropped 24 calves, with an average of 13 months between calvings; and the cows in lot 3 were bred 29 times and dropped 24 calves, with an average of 12 months between calvings. The average daily production per cow during the first period was for lot 1, 13.7 lbs. of milk and 0.6 lb. of fat; lot 2, 14.3 lbs. of milk and 0.6 lb. of fat; and lot 3, 11.7 lbs. of milk and 0.5 lb. of fat; and during the second period, lot 1, 10 lbs. of milk and 0.45 lb. of fat; lot 2, 12.5 lbs. of milk and 0.54 lb. of fat; and lot 3, 11.9 lbs. of milk and 0.56 lb. fat. Abnormal conditions, if any, occurring in the case of each animal are noted.

"Results indicate that the feeding of 5 lbs. of cotton-seed meal for any length of time is injurious to the dairy cow, causing inflammation of the udder, difficult breeding, and probably having a tendency to cause retention of afterbirth. Feeding cotton-seed hulls in the quantities given appears to cause difficult breeding, though not to the same extent as the feeding of cotton-seed meal. In the above test it has been clearly shown that bad effects may follow the use of cotton-seed meal in too large amounts."

Cotton-seed meal versus cold pressed cotton-seed cake for dairy cows, J. S. Moore (*Mississippi Sta. Bul. 174 (1914), pp. 11–13*).—In this experiment, which lasted 16 weeks, there were three lots of 7 cows each. During the preliminary period of three weeks all the cows were fed an average ration of 4 lbs. of cotton-seed meal, 7 lbs. of Johnson grass hay, and 42 lbs. of corn silage per head daily. During the next nine weeks each cow received Johnson grass hay and 3 lbs. of wheat bran daily, and in addition lot 1 received 5 lbs. of cotton-seed meal and 2.5 lbs. of cotton-seed hulls, lot 2, 7.5 lbs. of cold pressed cotton-seed cake, and lot 3, 5 lbs. of cotton-seed meal per head daily. During the final four weeks all the cows were fed 4 lbs. of cold pressed cotton-seed cake per head daily on good pasture. The average weekly milk production per cow was as follows: First period, lot 1, 163 lbs., lot 2, 165 lbs., and lot 3, 160 lbs.; second period, lot 1, 144 lbs., lot 2, 151 lbs., and lot 3, 144 lbs.; and third period, lot 1, 155 lbs., lot 2, 158 lbs., and lot 3, 157 lbs.

The cows in lot 1 made an average gain in weight during the 16 weeks of 12 lbs. per head, those in lot 2, 10 lbs. per head, while those in lot 3 lost 4 lbs. each.

The relative value of grain feeds as indicated by former tests at the station is given.

Feeding value of purchased feeds versus pasture versus soiling crops, J. S. Moore (*Mississippi Sta. Bul. 174 (1914), pp. 14–16*).—This experiment involved three lots of 5 cows each and lasted three periods of six weeks each. During the first period lot 1 received purchased feeds consisting of cotton-seed meal, wheat bran, alfalfa hay, and cotton-seed hulls; the cows in lot 2 were on good pasture of oats and hairy vetch; and the cows in lot 3 were fed alfalfa as a soiling crop. During the second period lot 1 received cotton-seed meal, wheat bran, and alfalfa hay; lot 2 were put on pasture of Bermuda, white clover, smooth vetch, and mixed grasses; and lot 3 were fed alfalfa and Johnson grass as soiling crops. During the third period lot 1 were fed on alfalfa and Johnson grass as soiling crops; lot 2 remained on pasture as in the second period; and lot 3 received purchased feeds. In addition, the cows on pasture and those getting soiling crops received about a half ration of cotton-seed meal, wheat bran, and cotton-seed hulls. All the cows were fed so that each lot would procure about the same amount of milk.

Lot 1, on purchased feeds, gave 10,676 lbs. of milk, the feed cost being $124.08 and the profit, over cost of feed, $124.12. The corresponding figures for lot 2, the cows on pasture, were 11,048 lbs., $50.41, and $206.39, and for lot 3, those on soiling crops, 10,912 lbs., $56.79, and $196.81. In figuring these feed costs and profits cotton-seed meal and wheat bran were valued at $28 per ton, green alfalfa and green Johnson grass at $1.50 per ton, Johnson grass hay at $12 per ton, alfalfa hay at $15 per ton, cotton-seed hulls at $8 per ton, and pasture per cow per month 75 cts. Milk was valued at 20 cts. a gallon.

[Dairy husbandry], J. M. Scott (*Florida Sta. Rpt. 1915, pp. XIX–XXI*).—Individual records of the cows of the station herd show that the feed cost of milk per gallon varied from 7.4 cts. to 20.2 cts. for different cows, the average for the entire herd of 24 cows being 13.6 cts. With milk at 32 cts. per gallon and butter at 40 cts. per pound a much larger profit was obtained from selling milk than from converting it into butter.

The results of an experiment with nine cows to determine the effect that dipping has on milk flow are shown in the following table:

Effect of dipping on milk flow of nine cows.

Period.	First dipping.	Second dipping.	Third dipping.	Fourth dipping.	Fifth dipping.	Sixth dipping.	Total.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Yield 5 days before dipping	376.9	281.5	296	248.5	187.7	187.1	1,577.7
Yield 5 days after dipping	341.1	251.2	264	211.9	204.3	168.1	1,440.6
Decrease from dipping	35.8	30.3	32	36.6	[a] +16.6	19.0	137.1

[a] Indicates increase.

Does it pay to take extra care of cows? C. C. HAYDEN (*Mo. Bul. Ohio Sta., 1 (1916), No. 8, pp. 245–248, figs. 2*).—Two cows of the station herd were put under official test conditions for one year. As compared with their previous treatment they were given better care and extra feed, and for a part of the year they were milked three times daily. Under these conditions the first cow, during her fifth lactation period, produced 14,722 lbs. of milk and 400 lbs. of fat, whereas her average production during the first four lactation periods was 8,194 lbs. of milk and 239 lbs. of fat. The production of the other cow during the test, which was her sixth lactation period, was 15,318 lbs. of milk and 505 lbs. of fat, whereas her average producton during the first five lactation periods was 8,195 lbs. of milk and 280 lbs. of fat. In these records one year from the birth of each half was taken as the lactation period.

For the first cow the feed cost during the test was 78 cts. per 100 lbs. of milk and 20 cts. per pound of fat. During her four previous lactation periods the average cost of feed on the same price basis was 89 cts. per 100 lbs. of milk and 22 cts. per pound of fat. For the second cow the corresponding feed costs during the test were 85 cts. and 18.5 cts., and for the first five lactation periods 86 cts. and 18 cts., respectively. For the first cow during the year of the test the total cost was $1.23 per 100 lbs. of milk and 36 cts. per pound of fat, and for the four previous years on the same basis $1.57 per 100 lbs. of milk and 45.7 cts. per pound of fat. For the second cow the total cost during the test was $1.28 per 100 lbs. of milk and 31.6 cts. per pound of fat, and for the five previous lactation periods $1.54 per 100 lbs. of milk and 38 cts. per pound of fat.

Digest and copy of law regulating the weighing, testing, and purchasing of milk and cream, W. J. CARSON (*New Jersey Stas. Circ. 62 (1916), pp. 3–16*).—In addition to a digest and copy of the law regulating the weighing, testing, and purchasing of milk and cream, the author gives the rules and regulations of the station for its enforcement and a list of creameries in New Jersey.

Cream testing balances, O. F. HUNZIKER, G. SPITZER, and G. L. OGLE (*Indiana Sta. Bul. 189 (1916), pp. 19, figs. 17*).—This bulletin presents data concerning the desirability, efficiency, and accuracy of the various types of balances commercially used in the testing of cream for milk fat, outlines notes on their condition, care, and manipulation, and gives specifications and tolerances established by the United States Bureau of Standards for standard cream test balances.

The results of the inspection by the station of 193 balances showed that the sensibility reciprocal, which, as defined by the Bureau of Standards, is the weight required to move the position of equilibrium of the pointer or other indicating device of the balance an amount equal to one division on the graduated scale or arc, averaged 0.0607 gm. with the balances loaded to full capacity and 0.0527 gm. when the balances were without load. The difference in the sensi-

bility reciprocal between balances with and without load was found to be considerably greater in the 6 to 12 bottle balances than in the 1 to 4 bottle balances. It was also found that the 12 bottle balances with and without load are very much less sensitive than the 1 to 4 bottle balances. Of the 193 balances inspected 31 were condemned because they failed to meet the requirement of sensibility reciprocal of 0.1 gm. Some of the balances were condemned because of inaccuracy of graduations on the beam which carries the traveling poise.

A comparison was made of duplicate tests made from the same samples of cream and weighed on a given balance. These tests and retests represented 4,623 samples of cream tested in commercial creameries, and four different types of balances were used. With the use of a one-bottle balance with a sensibility reciprocal of 0.01 gm. and involving 3,540 samples of cream, 96.43 per cent of the retests checked, with a four-bottle balance having a sensibility reciprocal of 0.01 gm. 79.52 per cent of the tests and retests of 376 samples checked; with a twelve-bottle balance having a sensibility reciprocal of 0.01 gm. 80.43 per cent of the tests and retests of 460 samples checked; and with a twelve-bottle balance having a sensibility reciprocal of 0.1 gm. the tests and retests of 247 samples checked in only 60.71 per cent of the cases.

In order to eliminate the effect of differences in technique in preparing the samples of cream and the personal equation in the manipulation of balances, 18 samples of cream were tested in duplicate using 16 different balances with each sample for weighing the cream. The work was done by one person under uniform conditions. With six balances having a sensibility reciprocal of 0.01 gm., and two balances having a sensibility reciprocal of 0.03 gm., 100 per cent of the duplicate tests checked; with two balances having sensibility reciprocals of 0.02 gm. and 0.03 gm., respectively, 94.4 per cent; with three balances having a sensibility reciprocal of 0.05 gm., 92.6 per cent; with one balance having a sensibility reciprocal of 0.08 gm., 77.8 per cent; and with two balances having a sensibility reciprocal of 0.1 gm., only 36.1 per cent. In these tests all duplicate tests varying within 0.5 per cent were counted as checks.

The effect of the degree of sensitiveness in cream balances on the speed of the operator is discussed.

Cooling cream on the farm, O. F. HUNZIKER, H. C. MILLS, and H. B. SWITZER (*Indiana Sta. Bul. 188 (1916), pp. 1087–1118, figs. 16*).—This bulletin reports the results of an experiment to show the effects of cooling cream promptly and properly on the farm.

Each of two cream routes of 20 patrons each of the Purdue University creamery was divided into two parts, and a preliminary test carried on which showed that the two groups were producing cream of similar quality under similar sanitary conditions. One-half of the patrons then received cream-cooling tanks and the other half took care of their cream without the use of special cooling tanks. The cream from each set of patrons was hauled to the creamery twice a week and received the same treatment in the butter-making process. The finished butter was scored at the station by three judges, shipped to New York and there scored by three judges, and sold on the basis of its market value.

During the experiment proper, which extended throughout August, 1915, the weather was wet and unusually cool and consequently the difference between the atmospheric temperature and the temperature of the water used for cooling was comparatively very slight. Notwithstanding this fact, it was found that the use of the cooling tanks produced a very marked improvement in the quality of the cream and of the butter made therefrom. Cream from the patrons using cooling tanks averaged 0.38 per cent acidity and scored 91.25 per cent, and cream from the patrons using no tanks averaged 0.52 per cent acidity and scored 88.75 per cent. It was noted that in the case of the tank cream the

flavor was uniformly clean, while the uncooled cream in most cases had an unpalatable flavor. Bacteriological analyses of the cream showed that the average reduction of micro-organisms ascribed to the use of cooling tanks in this experiment was 35 per cent of the total bacterial content, 35.8 per cent of the lactic acid bacteria, 72 per cent of the liquefiers, and 75 per cent of the undesirable yeast and molds. In fermentation tests the cooled cream produced a solid curd with a sharp separation of a clean whey. The majority of the fermentation tests from the uncooled cream showed a gassy curd and in some cases the curd underwent decomposition.

Analyses of all the experimental butter for moisture, salt, and curd showed average percentages about the same for each set of butter. Bacteriological analyses of samples of butter from each of the experimental churnings showed the following reductions ascribed to the use of the cooling tank. Total bacteria 58.6 per cent, acidifiers 60.2 per cent, liquefiers 81.9 per cent, and yeast and molds 87.4 per cent. The average score of the butter made from the uncooled cream was 88.98 at the station, and two weeks later at New York 87.69, and for the butter made from the cooled cream 91.63 at the station, and 89.7 at New York. With one exception the cooled-cream butter scored uniformly higher than the uncooled-cream butter, both at the station and at New York. On the open market in New York the price received for the cooled-cream butter was 24.88 cts. per pound, and for the uncooled-cream butter 23.94 cts. per pound.

The bulletin points out the essential features of satisfactory cream cooling tanks, gives notes on the use of springs and wells for cooling cream, and describes several types of homemade and commercial cooling tanks.

Progressive oxidation of cold-storage butter, D. C. Dyer (*U. S. Dept. Agr., Jour. Agr. Research, 6 (1916), No. 24, pp. 927–952, pl. 1, fig. 1*).—In preliminary work in this investigation, which was conducted in the Dairy Division of the Bureau of Animal Industry, the attempt was made to determine whether the undesirable flavors of storage butter arise from a decomposition occurring in the fat itself or in some one or more of the other components entering into the composition of the whole product. Examination of the air inclosed within packages of butter differently prepared and in butter fat alone was made with a specially designed gas apparatus which is illustrated and its manipulation described.

Very little alteration was found to occur in the composition of the air inclosed in sweet cream butter made from cream having an acidity (calculated as lactic acid) of 0.11 per cent when it was kept for about six months at a temperature of 0° F. A perceptible change in composition of the inclosed air was found when the butter was kept at a temperature of 32° and a very noticeable change when it was kept at room temperature. The sample of butter used, which contained a considerable number of bacteria, scored 92 when made, 91 at the end of three months, and 90 at six months when stored at 0°. At no time was there a trace of undesirable flavor.

An analysis was made of air extracted from butter made from sweet cream churned immediately after the addition of 15 per cent of a commercial starter. At the time of churning this cream had an acidity of 0.25 per cent. The butter made from this cream showed, so far as the composition of the air inclosed in it was concerned, a comparatively slight variation from that observed in the previous case of sweet-cream butter, when both samples were stored at a temperature of 0°. This butter scored 92 when made and 89 after 6.5 months, with no variation in flavor. Butter was also made from sweet cream churned immediately after the addition of lactic acid. The acidity of this cream was 0.71 per cent. On analysis the air extracted from a sample of this butter showed a pronounced decrease in the oxygen and carbon-dioxid content, even

when the butter was stored at a temperature of 0°, and this decrease was still more marked when it was allowed to remain at a temperature of 32°. This butter, stored at 0°, scored 93 when made, 88 at three months, and 84 at six months, and had a pronounced unclean flavor at the end of this time.

From these analyses it is concluded that the decomposition caused by cream acidity progresses at a temperature of 0° in a package of butter and can be measured by an analysis of the gas extracted therefrom.

A series of experiments was then undertaken to determine whether this measurable decomposition occurs in the fat of the butter itself, in the buttermilk, or in both. Fat from butter made from pasteurized cream was so prepared as to exclude, as far as possible, by melting, filtering, and washing, all ingredients of the butter other than fat. The butter fat so prepared was found to contain 0.05 per cent of protein (N×6.38). Samples of this fat kept in storage at 0° showed no physical alteration of any kind after six months or even after 1.5 years. Analyses showed that no chemical changes had occurred in fat kept in storage under these conditions for months, and an analysis of the extracted air showed that no appreciable oxidation had occurred during a storage interval of five months. A sample of this purified butter fat was exposed to the action of a large quantity of air and stored for about three and a half months at 32°. Under these conditions very little oxidation took place.

To determine whether oxidation takes place in one or more of the nonfatty constituents, butter was made from pasteurized cream ripened with a pure culture. A part of this butter was washed until the wash water was barely clear; another part was given additional copious washing in four changes of water; and with the third part the buttermilk was drawn off and the butter allowed to remain unwashed. Each of these samples was worked on a table worker to the extent of 40 revolutions. During the storage period the excessively washed butter and the normally washed butter were found to have practically the same keeping qualities as shown by scoring, and the chemical constants of the fat showed that there was very little or no chemical change. However, analyses of the confined air in these samples showed that the total amount of oxygen originally present underwent a markedly progressive decrease during storage at 0°. The sample of unwashed butter scored 92 at one month and 86 at six months, at which time it was stale, fishy, and sour. No noteworthy chemical change had occurred in the fat at six months, but striking changes had occurred in the composition of the confined air. The maximum amount of carbon dioxid (31.67 per cent) was found after a storage of three months, at about which time the characteristic "off-flavor" became distinctly noticeable. Very little oxygen was found in the sample after two months' storage. With another sample of unwashed butter 19.89 per cent of carbon dioxid was found in the butter 1.5 hours after manufacturing. This amount increased to 22.91 per cent at the end of two weeks when the butter was held in the dark at room temperature. Under these conditions the oxygen content decreased from 20.42 per cent at 1.5 hours to 10.61 per cent at the end of two weeks.

To further test the effect of air on the nonfatty ingredients of butter, tubes filled with broken pumice were impregnated with buttermilk from butter made from pasteurized cream acidified to 1 per cent with lactic acid before churning. This acid buttermilk was held at 32°. When the buttermilk was 4.5 days old it was found to contain 17.67 per cent of oxygen. At 26 days the oxygen content had decreased to zero. The carbon dioxid content of the buttermilk rose from 2.37 per cent at 4.5 days to 34.37 per cent at 26 days and decreased to 31.76 per cent at 62 days. In a control experiment with a 1 per cent solution of lactic acid the oxygen content remained practically constant and at

no time was there any carbon dioxid present. In a similar experiment with buttermilk from sweet cream butter made from pasteurized cream having an acidity of 0.108 per cent the inclosed air underwent practically no change in 270 days' storage at 0°.

The author summarizes the investigations as follows: "The development of undesirable flavors in butter held in cold storage at a temperature of 0° is not dependent upon an oxidation of the fat itself. The production of 'off-flavors' so commonly met with in cold-storage butter is attributable to a chemical change expressed through a slow oxidation progressing in some one or more of the nonfatty substances occurring in the buttermilk. The extent of this chemical change is directly proportional to the quantity of acid present in the cream from which the butter was prepared. The quantity of carbon dioxid present in cold-storage butter appears to have a certain relation to the quantity of buttermilk in the butter. During storage this quantity of carbon dioxid may increase to a maximum followed by a progressive decrease."

VETERINARY MEDICINE.

Live stock disease investigations, L. B. Barber (*Guam Sta. Rpt. 1915, pp. 25–41, pls. 2, figs. 4*).—Cattle ticks, which are so widely spread on the island that few calves succeed in avoiding serious infestation, are said to constitute the greatest obstacle in the way of the cattle industry in Guam. B. H. Ransom of the U. S. Department of Agriculture has identified the species as *Margaropus annulatus caudatus*, and the author has been unable to differentiate the ticks infesting cattle and those on horses, carabaos, goats, and deer. That serious infestation takes place during the dry season it is thought may be explained in part by the fact that the cattle at that time of the year are usually in poor condition due to the absence of proper feed.

Observations on the biology of this tick indicate that the life history is essentially the same as that of *M. annulatus*. Temperature charts of animals severely infested with ticks are presented and discussed. Examinations of the blood of an animal during periods of high fever have shown the presence of a parasite that is smaller than *Piroplasma bigeminum*.

Comparatively few fenced pastures are to be found in Guam, and practically all the cattle that are not running in more or less of a wild state in the interior of the island are used as cart animals, traveling from village to village and from ranch to ranch, thus making it exceedingly difficult to maintain and enforce a quarantine. In eradication work, the horses, carabaos, goats, and deer as well would have to be taken into consideration.

Liver flukes (*Fasciola hepatica*) have been found to infest cattle, hogs, and goats. A post-mortem examination of 32 beef carcasses at the city market in Agana showed 26 livers to be infested and 4 gave evidence of previous infestation with flukes, while 9 livers of 14 hog carcasses inspected were infested and 2 showed the effects of flukes. The livers of some of the cattle examined were almost totally destroyed by the flukes, though the animals appeared to be in a fairly healthy condition. Few, if any, cattle succumb as a direct result of fluke infestation, but the fluke undoubtedly materially checks the growth and influences to a considerable degree the normal development of a young animal. Infestation of goats and swine, especially the former, is apparently more serious, and if allowed to remain uncorrected eventually will result in a high mortality. Among the preventive measures mentioned the author suggests the introduction of frogs and toads, which do not occur on the island, to assist in the eradication of snails, the intermediate hosts.

A stomach worm, thought to be *Hæmonchus contortus*, has been found on the island in only one case, that of a native cow.

It is said that the seriousness of the parasitic infestation of swine can hardly be overestimated. The kidney worm (*Stephanurus dentatus*) and a lungworm, probably *Strongylus paradoxus*, are important parasites, the latter causing the most serious and fatal disease of swine on the island.

Coccidial white diarrhea is said to cause large losses among chicks at the station. Success in combating this disease has resulted from proper care, including the use of a medicated drinking water made up of 1 gal. of bichlorid of mercury solution (1:10,000), 3 grains of citric acid, and one 30-gm. sulphocarbolate tablet. In tests made of the efficacy of this treatment, it was found that the chicks not given the medicinal drinking water nearly all succumbed, whereas those receiving it have not averaged a loss of more than two chicks per hatch. It is stated that in the absence of proper treatment and the presence of such predisposing causes as improper brooding and poor feeding the mortality will run between 90 and 100 per cent, whereas by eliminating all predisposing causes and using the treatment above recommended the mortality should be reduced to 5 per cent or less.

Chickenpox or sorehead is the most widely disseminated poultry disease on the island. Chicken cholera is said to have done more to discourage the poultry industry than any other factor, two outbreaks having been investigated during the year. Diphtheritic roup is present in all parts of the island, investigations having shown as many as 50 per cent of a brood of young chicks to be affected, and the mortality among untreated chicks going as high as 90 per cent.

The endoparasites of poultry mentioned as occurring on the island are several species of tapeworm, the common roundworm, the ceca worm, small round worms which inhabit the proventriculus, and at least one species of eye worm. Eighteen per cent of chicks between four and six months of age which died at the station were found to be infested with a nematode, probably *Tetrameres fissispinus*. The eye worm, which resembles Manson's eye worm, is said to be commonly found infesting the native fowls. Ectoparasites mentioned are two species of lice, *Menopon pallidum* and *Goniocotes gigas* and a mite, *Dermanyssus gallinæ*.

[Report of the veterinary department], J. W. CONNAWAY and A. J. DURANT (*Missouri Sta. Bul. 141 (1916), pp. 39–42*).—In hog-cholera immunity investigations, continuing the studies previously noted (E. S. R., 33, p. 278), "negative results were obtained with the experimental antigen prepared from the blood, kidneys, and lymph nodes of a few pigs suffering from the acute hemorrhagic type of cholera. More extensive work was done with spleen antigens from acute cholera cases, and ulcer antigens from chronic cases, and better results were obtained."

The results obtained clearly demonstrated that a distinct complement-fixation reaction occurred with the serum of cholera-immune hogs when an extract from the spleen pulp of an animal that had died from an attack of the acute hemorrhagic type of the disease was used as antigen.

"The question remains open, however, as to whether the results obtained were due to a specific hog-cholera antigen in the spleen extracts, or to associated antigens. But in this connection it is pertinent to state that the cholera spleen from which the experimental antigens were prepared failed to yield cultures of the Salmon bacillus (*Bacillus suipestifer*), the micro-organism most commonly associated with the filterable virus of hog cholera. Moreover, tests made with an antigen prepared from a pure culture of *B. suipestifer* gave no deviation of

the complement with serum samples obtained from hogs which gave a positive reaction to the spleen antigen extracts."

Experimental antigens were also prepared from the intestinal button ulcers of hogs affected with the chronic type of the disease. No definite conclusions, however, could be drawn from the positive reactions obtained with these antigens, since the necrotic ulcers used undoubtedly contained "a number of contaminating micro-organisms and toxic products which have no causative relation to hog cholera but which under certain conditions possibly may stimulate the production of their special antibodies in the blood of a cholera-infected hog. *B. coli communis*, *B. suipestifer*, *B. necrophorus*, and *Spirochæta hyos* have all been found in these ulcers."

Small quantities of the positive-reacting ulcer material injected into susceptible pigs produced typical cases of hog cholera. Preliminary data indicate the possibility of ultimately using the complement-fixation test in determining the variations in the potency of serum. An attempt is being made to isolate the antigen from the positive-reacting spleens and ulcers in as pure a form as possible.

In contagious abortion investigations, "29 suspected herds, comprising a total of 610 cattle, have been tested. Including animals retested, 1,218 blood-serum samples have been examined. Twenty-four, or a little over 80 per cent, of the suspected herds contained positive-reacting animals with a history of abortion. In one herd, in a group of 70 cows, 41 gave a positive reaction, and 29 a negative reaction. . . . In other herds the percentage of positive reactors was less. Taking the entire number of animals tested in the infected herds 43 per cent gave a positive reaction."

The value of the test to the cattle owner in preventing the spread of the infection and in its eradication is indicated.

Text-book of meat hygiene, R. EDELMANN (*Lehrbuch der Fleischhygiene. Jena: Gustav Fischer, 1914, 3. rev. ed., pp. XVI+442, pls. 4. figs. 221*).—The third revised German edition of this work, of which American editions have been previously noted (E. S. R., 35, p. 681).

The physical chemistry of disinfection, I, J. F. NORTON and P. H. HSU (*Jour. Infect. Diseases, 18 (1916), No. 2, pp. 180–194, fig. 1*).—The results of the study reported are summarized as follows:

Acids act as disinfectants through the agency of the hydrogen ions produced by electrolytic dissociation. The disinfecting power of an acid is approximately proportional to the hydrogen-ion concentration. The addition to an acid of a salt containing an anion common to this acid diminishes its disinfecting power, as the result of a decrease in the hydrogen-ion concentration and an increase in the concentration of the undissociated acid molecules. Salts which do not appreciably affect the dissociation of an acid greatly increase the disinfecting properties of the acid. Acid anions are positive catalyzers and undissociated acid molecules are negative catalyzers in acid disinfection.

The early determination of pregnancy in domestic animals, E. R. WECKE (*Flugschr. Deut. Gesell. Züchtungsk., No. 35 (1915), pp. 56*).—This pamphlet discusses the importance to the breeder of an early diagnosis of pregnancy, the methods commonly employed, the theoretical principles of the dialysis procedure, and the anatomical possibilities of the entrance of fetal material into the circulating blood of the mother. The dialysis method and its manipulation are described in detail.

From experimental data reported the author concludes that the dialysis procedure is a valuable and accurate method for the determination of pregnancy in cattle, especially in the early stages where the usual means of

diagnosis are unreliable. A bibliography of 47 references to the literature is included.

The variations in reaction of the blood of different species as indicated by hemolysis of the red blood cells when treated with acids or alkalis, J. G. Cumming (*Jour. Infect. Diseases, 18 (1916), No. 2, pp. 151–179, figs. 11*).—The author reports hemolytic and chemical time indexes and their equivalent NH_3, NaOH, and HCl percentages of the erythrocytes of the dog, bear, horse, mule, white rat, brown rat, turtle, guinea pig, rabbit, frog, pigeon, hog, monkey, chicken, cat, elephant, cow, deer, sheep, goat, negro, and Caucasian.

"For the 15-minute hemolytic system there is a marked difference in the chemical requirements (NH_3, NaOH, and HCl) for some species, while the difference is not so marked for others. For this system one of the three chemical hemolysins may be of the same percentage for two species; invariably there appears, however, a difference in the percentage requirement for either one or both of the other two chemical hemolysins. The NH_3 hemolytic time indexes divide the animals tested into four fairly distinct groupings. The position of the NaOH hemolytic time indexes of the different species corresponds closely to that of the NH_3 indexes. There is no special arrangement of the HCl time indexes for the different species with relation to the alkaline indexes." Alkaline hemolysis is deemed due to the OH group and acid hemolysis to the H ion.

It is indicated that the chemical and hemolytic time indexes may be used to identify blood-cell suspensions of different species with a considerable degree of accuracy. The hemolysis of the red blood cell may be used as an indicator to determine the degree of acidity or alkalinity of certain solutions. As an indicator these cells are affected by the isotonicity of the blood suspension. "Alkaline hemolysis can be influenced by acids, and acid hemolysis by alkalis. Both acid and alkaline hemolysis can be influenced by the neutral salt content of the suspension."

A distinct variation between the normal and pathological blood of the same species was observed in most of the specimens tested. This variation is deemed probably due to an increased alkalinity or decreased acidity or to variation in the neutral salt content.

A practical method for the identification of guinea pigs under treatment, A. P. Hitchens (*Jour. Bact., 1 (1916), No. 5, pp. 541–545, fig. 1*).—A system for identifying laboratory animals based on a study of abbreviations is described. It is indicated that by this system animals can be both rapidly described and easily recognized.

The anticoagulant action of acid anilin dyes toward albuminous materials, A. C. Hollande (*Compt. Rend. Acad. Sci. [Paris], 162 (1916), No. 25, pp. 959–961*).—From experiments made by treating ascitic fluid, cerebro-spinal fluid, pleural exudate, ovalbumin, etc., with various acid and basic dyes, as eosin, orange G, uranin, Congo red, light green, etc. (equal volumes of fluid and 2 per cent solutions of the dye), it was found that the acid dyes combined with the protein substances and formed colored acid albumins. These substances were not coagulated at the boiling temperature or on being sterilized in an autoclave at 120° C. for 20 minutes.

On boiling a mixture of a soluble protein and an acid dye a transparent jelly was obtained which could be further heated at 120° without changing its character. It is indicated that by the proper choice of a nontoxic acid dye media suitable for bacteriological use can be prepared in this manner.

It is further indicated that the property possessed by the acid dyes of combining with protein material substantiates the idea that histological staining is a physicochemical reaction (eosinophilic, acidophilic), and not merely a purely physical (adsorption, solution) action.

A method of studying the effect of serum upon tissues, S. FELDSTEIN (*Proc. Soc. Expt. Biol. and Med., 12* (*1915*), *No. 8, pp. 187–191*).—A histological method for studying the effect of serum on various tissues is described in detail.

After incubation of the tissue with serum and proper staining marked changes in the structure were observed, the most striking changes being found in the nuclei. The nuclei had either disappeared entirely or failed to take the stain.

The results are briefly discussed.

The effect of lecithin and horse serum on the hemolytic action of certain peptones, A. A. EPSTEIN (*Jour. Immunol., 1* (*1916*), *No. 3, pp. 183–188*).—Continuing previous work [a] the author has shown that lecithin alters the hemolytic and agglutinative action of the peptones in relation to different species of red blood cells.

"It seems apparent that the increase in the hemolytic activity of the peptones resulting from the addition of minute amounts of lecithin is not due to the intervention of a lipolytic ferment and the subsequent splitting off of a fatty acid from the lecithin."

The activation of the peptones can be accomplished not only by the addition of pure lecithin to them but also by the addition of horse serum, as in the case of cobra venom. The activation of the peptones with serum is not so marked as with the lecithin. Whole serum fails to activate the peptones and interferes with their hemolytic action. After extraction with ether the serum does not activate the peptones in any dilution.

The relation of lipoids to immune reactions, J. W. JOBLING (*Jour. Immunol., 1* (*1916*), *No. 4, pp. 491–500*).—This is the presidential address delivered at the third annual meeting of the American Association of Immunologists, held at Washington, D. C., May 11 and 12, 1916. The subject is reviewed in detail and a bibliography of 67 references to the literature cited is appended.

A new method of active immunization, M. FRANKENHUIS (*Tijdschr. Diergeneesk., 43* (*1916*), *No. 16, pp. 597–602*).—A method of immunization which depends on the slow, continued absorption of the virus is described. The virus is introduced into the animal in a capillary tube which is placed under the skin by a rather simple operation. The slow absorption takes place from the material introduced. A permanent active immunity is thus obtained, as indicated by experimental data submitted.

The use of the new procedure as a prophylactic against spotted fever and foot-and-mouth disease is suggested and outlined. Advantages claimed for it are that it is not dangerous even though the lethal dose is introduced; a greater and more permanent immunity can be obtained than with any of the other methods in general use; immunization is possible even though no pure culture is at hand; and the method can be used in conjunction with other methods if desired.

The introduction of the capillary tube as foreign material is indicated as a disadvantage, although the danger with sterile material is deemed to be slight.

A simplified method of producing a potent precipitin serum, W. V. SMITH (*Jour. Med. Research, 34* (*1916*), *No. 2, pp. 169–175*).—In cases where human blood or blood serum can not be readily obtained at all times the author recommends the precipitation of the protein with ammonium sulphate and the use of the precipitate for the production of a potent precipitin rabbit serum by intraperitoneal injection. The preparation thus obtained can be kept on hand for a long time, "at least nine months, and no doubt indefinitely." The danger to the animal to be injected is greatly reduced by using the concentrated material, as a smaller quantity is injected and the preparation is sterile, or nearly so.

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[a] Jour. Expt. Med., 15 (1912), No. 5, pp. 485–497.

Serum osmose. The treatment of wounds by blood serum obtained through osmosis, P. CHATELAIN (*Rec. Méd. Vét., 92 (1916), No. 13, pp. 393–397*).—The author describes a procedure for wound treatment in which either powdered sodium chlorid or a solution of suitable strength of the salt is used as a dressing. By this treatment the wound becomes naturally saturated with the blood serum.

The results of the new treatment indicate that the use of sodium chlorid is superior to the use of either boric or picric acid. Suppuration is checked immediately and cicatrization is rapid and complete.

The specific serum treatment of wounds, E. LECLAINCHE and H. VALLÉE (*Rev. Gén. Méd. Vét., 25 (1916), No. 295, pp. 306–316*).—This is a general discussion of the treatment of wounds with polyvalent sera either by injection or direct local application as recently introduced by the authors.

The destruction of anthrax spores in hides and skins by caustic soda, E. HAILER (*Arb. K. Gsndhtsamt., 50 (1915), No. 1, pp. 96–121*).—A 0.5 to 1 per cent solution of caustic soda at a temperature of 15 to 20° C. (59 to 68° F.) was found to destroy anthrax spores in cattle hides and sheep and goat skins. The germicidal action of the solution was increased by the addition of a 5 to 10 per cent solution of sodium chlorid, the spores being destroyed in 72 hours in almost all the cattle hides and sheep skins tested.

Experimental studies on the immunity of foot-and-mouth disease, C. TERNI (*Clin. Vet. [Milan], Rass. Pol. Sanit. e Ig., 39 (1916), No. 9, pp. 257–261*).—The author has found that the virus of foot-and-mouth disease can be preserved indefinitely by the passage of virulent blood, as well as the product of the local lesions, through sensitized animals. The best procedure for conserving the virulence and controlling an active infection of the virus was found to be the use of infective material from the blood of an animal in a high febrile condition or the product of the local lesions. Other species of animals harbor the virus of the disease through various periods of time without manifesting any external symptoms. With the blood preserved in a thermostat after being attenuated by cooling a resistance to the disease can be obtained by the successive inoculation of the virus which is much greater than that manifested by animals which have survived a severe case of the disease. The blood serum of animals which have survived the disease possesses remarkable prophylactic properties against the virus, and the inoculation of such blood containing the maximum amount of antibodies causes a rapid recovery of animals in advanced stages of the disease. Practical serotherapy thus seems to be possible.

Two forms of immunity are distinguished, a general immunity localized in the blood, especially in the white corpuscles (eosinophils?), red corpuscles, and plasma, and another localized in the protective epithelium. The latter is indicated as being the most permanent.

The clinical form of the disease varies in degree according to the previously existing immunity. On post-mortem examination of animals which had died from the disease the virus was found to be localized in different organs, especially in the cardiac muscles, brain, liver, and kidneys. Less was found in the spleen and in the bone marrow.

In the epithelial lesions two substances were found (granulo-stimoline and granulo-lysin) which are indicated as possessing chemotactic properties which produce an eosinophilia.

Tuberculosis of the seminal vesicles, vas deferens, and urethra in the bovine, P. CHAUSSÉ (*Rec. Méd. Vét., 92 (1916), No. 13, pp. 397–408, figs. 3*).—The author reports a case and describes the lesions and histopathological findings. The probable route of infection in the case reported and similar ones is discussed.

The influence of tuberculosis on the chemical composition of the animal body, K. Dröge (*Pflüger's Arch. Physiol., 163 (1916), No. 4–6, pp. 266–288, pls. 2*).—Analytical data of the chemical composition of normal and tubercular guinea pigs are reported in detail. The weights of the animals, taken weekly over a period of a number of months, and the post-mortem findings in a number of animals are also reported.

While the data show a normal fat content in animals in which there was either no active infection or a process of recovery and a low fat content in severely infected animals or animals which had died from the disease, the author contends that a high fat content with an increased resistance or a low fat content with a decreased resistance is not necessarily always the case. In slightly affected animals the water content was found to be normal, while in acutely affected animals a considerable increase was noted.

The data submitted, together with that reported by earlier investigators, are discussed in detail.

Studies in immunity to tuberculosis, A. K. Krause (*Jour. Med. Research, 35 (1916), No. 1, pp. 1–50*).—Three studies are reported.

I. *Experimental studies on the cutaneous reaction to tuberculo-protein.—Factors governing the reaction* (pp. 1–23).—It was found that cutaneous hypersensitiveness to tuberculo-protein is inaugurated by the establishment of infection and the development of the initial focus. The hypersensitiveness increases with progressive disease and varies directly with the extent and intensity of the disease. With the healing of the disease it diminishes but is probably never entirely lost (except in the presence of intercurrent disease, pregnancy, etc.). It is increased by reinfection and diminished or completely wiped out during the period of general tuberculin reaction.

It is suggested that "tissue hypersensitiveness may be a function of immunity to reinfection."

II. *The anaphylactic state in its relation to resistance to tuberculous infection and tuberculous disease.—An experimental study* (pp. 25–42).—"Anaphylactic shock, experienced by guinea pigs a short time before infection with tubercle bacilli of low virulence, did not reduce their resistance to such an extent that the parasitism of the particular micro-organism concerned was markedly increased, although there were suggestions that the extent of disease was probably increased. If tuberculous disease of low grade is once established in guinea pigs a single attack of anaphylaxis does not bring about conditions that favor the extension of the disease. Anaphylactic shock suffered just before the inoculation of a nonpathogenic acid-fast organism, the Mist bacillus [Möller's grass bacillus], does not lay the body open to progressive invasion by this germ.

"No success attended the efforts to enhance the virulence of a strain of the tubercle bacillus (*R1*) when the method of Thiele and Embleton was followed. Evidence is submitted that tubercle bacilli can preserve their viability and their original virulence after being kept in a dried state for as long a time as from 15 to 17 months."

III. *Concerning the general tuberculin reaction* (pp. 43–50).—"An extract of an animal's own normal tissues if introduced rapidly into its circulation is toxic. The products of tuberculous foci are primarily toxic if received into the blood stream (or, perhaps, lymph stream)."

It is suggested that "the symptoms of the general tuberculin reaction are due to the primary toxicity of focal products, the absorption of which is favored by the focal reaction that results from the injection of tuberculin."

The antigenic properties of tubercle wax, B. Lucke (*Jour. Immunol., 1 (1916), No. 4, pp. 457–464*).—From a study on the possible antigenic value in serum diagnosis of tubercle wax the author found that the wax antigens caused

complement deviation with a high percentage of sera possessing lipotropic properties. "These antigens also cause complement deviation with a moderate percentage of presumably normal and tuberculous sera."

It is indicated that such antigens possess neither diagnostic nor prognostic value in the serum diagnosis of tuberculosis.

Present status of the infectious abortion problem, L. R. HIMMELBERGER (*Amer. Jour. Vet. Med., 11 (1916), No. 9, pp. 699–702*).—This article briefly reviews the more recent literature concerning the progress being made with a general view to combat the disease.

Some experiments with bacterial vaccines for the cure of splenetic tick fever in cattle, R. L. RHEA and G. W. MACKIE (*Jour. Amer. Vet. Med. Assoc., 49 (1916), No. 3, pp. 361–365*).—The etiology, symptoms, post-mortem lesions, and differential diagnosis of the disease are briefly reviewed.

The experimental work reported covered a period of six months. One hundred and forty cases were treated, 118 of which made good recovery. The cattle ranged in age from eight months to aged animals. The vaccine used was a combined streptococcus and staphylococcus.

It is indicated that "the body of all animals is at all times the host of microorganisms which are incapable of setting up disturbances when the body has a high resistance, but if for any reason the body resistance should drop below normal in vitality these same latent organisms may become pathogenic. The infection producing tick fever primarily is *Piroplasma bigeminum;* however, when by its action the resistance of the body is reduced below normal, these organisms may cause a secondary infection and with their toxins may assist in producing symptoms which accompany tick fever. . . . The fact that immunity can be established by blood inoculations warrants us in saying that antibodies may be produced in the blood by proper stimulus, and as the agent used in this test work is a streptococcus and staphylococcus vaccine [and] antibodies produced by this type of vaccine combat only that type of invasion we may conclude they play an important rôle in this disease."

The action of organic body fluids on the bacillus of swine erysipelas, V. COLOMO (*Bol. Inst. Nac. Hig. Alfonso XIII, 12 (1916), No. 46, pp. 87–97*).—Serological experiments are reported from which the author concludes that the antiserum of swine erysipelas obtained from rabbits possesses agglutinative and bacteriotropic properties the same as that obtained from the horse. The bone marrow contains rather large amounts of antibodies, although not so great as might have been expected. The blood of immune rabbits is richest in agglutinins.

In conformity with earlier views the spleen was found to have no defensive rôle against septicemical infections. The same may be affirmed of the other organs with the exception of the bone marrow. Antibodies were found in sufficient quantities in the bone marrow to have a detrimental action on the bacillus of the disease, a fact which is in agreement with earlier investigations in which considerable quantities of antibodies of typhoid fever and pneumonia were found in the bone marrow.

Report to the council of the National Pig Breeders' Association on the present state of knowledge of swine fever with special reference to the available statistics, M. GREENWOOD, JR. (*Borrowash, England: Nat. Pig Breeders' Assoc., 1914, pp. 69+III*).—This material has been previously noted from another source (E. S. R., 32, p. 881).

The results of the use of hog-cholera globulin on three thousand hogs in the field, R. GRAHAM (*Amer. Jour. Vet. Med., 11 (1916), No. 9, pp. 703–707*).—Detailed experimental results are reported, from which the author concludes that hog-cholera globulin possesses immunizing properties equal to the whole

unrefined cholera serum. The globulin was found to protect against natural exposure and artificial infection (1 to 5 cc. virus) in doses of 0.2 cc. per pound weight. On account of its concentration the globulin may be used in much smaller doses and thus offers the advantage of reducing the labor of administration. "It seems reasonable to assume that a small immunizing dose is absorbed more rapidly by the animal as the units of value are more quickly available." Being a sterile product, it is found more desirable for use than the unrefined serum.

Hog cholera in Pennsylvania, R. M. Staley (*Penn. Live Stock Sanit. Bd. Circ. 43 (1916), pp. 13*).—This bulletin discusses the distribution, symptoms and lesions, cause, methods of spreading the disease, treatment, prevention, and the serum-virus and serum-alone treatments. Regulations with reference to hog cholera adopted by the State Live Stock Sanitary Board to protect and encourage the swine industry of Pennsylvania are included.

The maintenance of virulence of Bacillus abortivus equinus, E. S. Good and W. V. Smith (*Jour. Med. Research, 33 (1916), No. 3, pp. 493–498*).—In a study of the virulence of certain cultures of *B. abortivus equinus*, it was found that the intravenous inoculation of a mare with 1 cc. of a mixed culture of the organism which had been grown in the laboratory at the Kentucky Experiment Station for from 10 to 30 generations and for from one and a half to four years caused a typical abortion. Previous tests of the animal's blood showed no immunity to the disease. At the time of inoculation the animal was protected with 200 cc. of a hyperimmune serum which possessed marked bacteriolytic properties.

The intravenous inoculation of 0.1 cc. of 24-hour broth cultures produced death in rabbits in from two to four days, and the subcutaneous inoculation of 1 cc. of a broth culture produced abortion in guinea pigs in four days and seventeen days. The organism producing these effects was in each instance isolated from the animal after death.

Contagious epithelioma in chickens (chicken pox, swelled head).—Its control by vaccination, W. B. Mack and E. Records (*Nevada Sta. Bul. 84 (1916), pp. 3–32, figs. 19*).—A popular abstract of Bulletin 82 (E. S. R., 34, p. 189) amplified and illustrated.

RURAL ENGINEERING.

Official proceedings of the Twenty-first International Irrigation Congress held at Calgary, Alberta, Canada, October 5–9, 1914 (*Off. Proc. Internat. Irrig. Cong., 21 (1914), pp. XXVIII+402, pls. 9, figs. 31*).—These proceedings contain the following special articles bearing on the subject of irrigation: Failure of Irrigation and Land Settlement Policies of the Western States, Water Storage and Distribution by the United States Reclamation Service, The Dominion Government Laws Respecting Irrigation in Western Canada, Colonizing in Western Canada, British Columbia Irrigation Policies, The Necessity of a Higher Duty of Water, Farm Development in the Arid West, Administration of Water Rights in British Columbia, Irrigation and Saskatchewan Agriculture, Relation of the Farmer to the Irrigation Project, Irrigation in Alberta and the Settler on Irrigated Land, Some Irrigation Problems in Texas, Recent Irrigation District Legislation in California, Irrigation Enterprises of the Canadian Pacific Railway Company in Alberta, Storage and Power Possibilities of the Bow River West of Calgary, The Great Falls Plan of Cooperation between the City and Farming Community, Silt Problems of the Colorado River, and Irrigation Conditions in the State of Washington.

Report of the undersecretary of state on the Ministry of Public Works, 1914–15 (*Rpt. Min. Pub. Works Egypt, 1914–15, pp. VII+126, pls. 21*).—This report deals especially with irrigation and irrigation works in Egypt.

The flow of water over sharp-edged notches and weirs, H. J. F. GOURLEY and B. S. CRIMP (*Minutes Proc. Inst. Civ. Engin.* [*England*], *200* (*1915*), *pt. 2, pp. 388–408, figs. 4*).—Experiments on the flow of water over sharp-edged, triangular, and rectangular weir notches are reported.

It was found that "the flow over a triangular notch is proportional to $H^{2.47}$ and varies in direct proportion to the ratio of width to height. The general law is Q=2.48, n. $H^{2.47}$, in which Q is the discharge in cubic feet per second, n the tangent of half the included angle of the notch, and H the head in feet.

"The flow over any trapezoidal notch is equal to the flow over a rectangular weir of equal length with two end contractions plus the flow through a triangular notch of corresponding angle.

"The flow over a rectangular weir with end contractions varies as $H^{1.47}$ and increases rather more rapidly than the length, i. e., as $L^{1.02}$, and is given by the formula $Q=3.10\ L^{1.02}\ H^{1.47}$, which applies to all weirs up to at least 19 feet in length, and, to judge from the comparisons made for short weirs, for heads up to half the length of the weir, provided the depth of pool below the sill of the weir is not less than twice the head. In the formula, Q is cubic feet per second, L the length in feet, and H the head in feet."

Abnormal coefficients of the Venturi meter, A. H. GIBSON (*Minutes Proc. Inst. Civ. Engin.* [*England*], *199* (*1915*), *pt. 1, pp. 391–408, pl. 1*).—Investigations conducted at University College, Dundee, on the causes of abnormal values of the coefficient C used in the base formula for the venturi meter, $Q=CA\sqrt{\frac{2gh}{m^2-1}}$ are reported which led to the following conclusions:

"In any meter, in good order and of normal proportions, friction does not affect the value of C by more than about 2 per cent so long as the diameter of the pipe line is greater than about 2 in. For large meters at velocities exceeding 1 ft. per second the effect is in general less than 1 per cent. The effect increases very slightly with a diminution in velocity. With pipe line velocities less than about 0.5 ft. per second the steadying of the velocity at the throat causes a distribution of velocity under which the kinetic energy at the throat is appreciably greater than $\frac{v^2}{2g}$ feet. In a meter fitted with the usual U-tube gage, or any modification of this type, this may reduce the apparent value of C to a minimum of about 0.75 at low velocities. Values of C obtained from a meter when measuring a pulsating flow are less than with constant flow. If k is the proportional fluctuation of velocity per cycle on each side of the mean, C is reduced in the ratio $1\div\sqrt{1+\frac{k^2}{2}}$. Except, as where used for metering the discharge from a reciprocating pump, k may be large, any such effect is in general small.

"The effect of whirl in the water approaching the meter is to increase the value of C. The effect is, however, small; is approximately constant at all velocities; and it is extremely improbable that in the normal pipe line it exceeds about 1 per cent.

"Where the pressure orifice at throat or entrance of a meter consists of a circumferential gap, the width of this gap has some effect on the value of C. In a meter having a throat diameter of 1 in. the effect is, however, small, except at very low velocities, so long as the width does not exceed 0.4 in. The author found that at medium and high velocities maximum values of C were

obtained with the minimum (0.015 in.) gap, and minimum values with a gap of 0.06 in. At velocities less than 0.1 ft. per second the effect of a variation in this width becomes very pronounced.

"Abnormally high values of C at moderately low velocities are to be attributed to errors in the throat gage reading, due to the accumulation of air at the throat. Such high values are only to be anticipated in a meter in which the throat pressure is less than atmospheric, and probably only where independent measuring columns are used at entrance and at throat, and where communication between throat and measuring column takes place through a circumferential gap surrounding the throat. Where a U-tube gage or any of its modifications has been used there would appear to be no record of any such high values of C, and such a device should be used where there is reason to anticipate negative pressures.

"An examination of all available data shows that, whatever the conditions under which a meter may be operating, the value of C varies within narrow limits so long as the pipe line velocity exceeds 1 ft. per second. This coefficient may vary from about 0.96 to slightly over unity. In the normal meter of moderate or large size a value of 0.99 will probably give the value within 2 per cent for any velocity exceeding 1 ft. per second. Where essential that the records for lower velocities should be accurate, this can only be insured by a calibration of the meter."

Pumps for the irrigation of small areas, B. Dibble (*Jour. Electricity, 37 (1916), No. 4, pp. 65–67, figs. 3*).—Factors to be observed in the selection of centrifugal pumps for the irrigation of small areas are discussed.

Experiments upon the purification of sewage and water at the Lawrence Experiment Station, H. W. Clark and G. O. Adams (*Ann. Rpt. Bd. Health Mass., 46 (1914), pp. 297–346*).—These experiments include special studies "of the relative efficiency of trickling filters of different depths, of the disposal and utilization of sewage sludge, of the purification of sewage by aeration in tanks containing layers of slate upon which 'growths' form, etc., and of the purification or disinfection of water by means of liquid chlorin."

Sewage disposal for isolated residences, C. G. Gillespie (*Cal. Bd. Health Spec. Bul. 8 (1916), pp. 2–8, figs. 4*).—This bulletin describes the septic tank and tile absorption method of residential sewage disposal.

"The tank must be located judiciously, so that prevailing winds will carry odors in a direction away from dwellings and so that wells and watercourses will not be polluted by the effluent. Under ordinary conditions, for safety, 200 ft. should separate the tank and the nearest well, watercourse, homes, or highway."

Sanitation in the mountains, C. G. Gillespie (*Cal. Bd. Health Spec. Bul. 10 (1916), pp. 3–20, figs. 8*).—This bulletin deals with the sanitary privy and septic and Imhoff tanks for the disposal of sewage in mountain resorts.

Engineering operations for the prevention of malaria, F. D. Evans (*Minutes Proc. Inst. Civ. Engin. [England], 200 (1915), pt. 1, pp. 2–61, figs. 12*).—This is a presentation of the details of these operations.

Terracing in Texas, J. C. Olsen (*Agr. and Mech. Col. Tex. Ext. Serv. Bul. B–23 (1916), pp. 3–32, figs. 27*).—This bulletin describes and illustrates methods of erosion prevention practiced in Texas.

The use of dynamite in clearing land, E. Secrest (*Mo. Bul. Ohio Sta., 1 (1916), No. 8, pp. 236–239, figs. 2*).—The cost of dynamiting white oak, beech, hickory, chestnut, black oak, maple, cherry, and black gum tree stumps ranging in age from six months to 25 years and in diameter from 6 in. to 42 in. are

reported. The number of 0.5-lb. sticks of dynamite used per stump varied from 1 to 9.5, averaging 3, and the cost per stump varied from 20 cts. to $1.68, averaging 59 cts.

Brief instructions on handling the explosive are also included.

British standard nomenclature of tars, pitches, bitumens, and asphalts, when used for road purposes, and British standard specifications for tar and pitch for road purposes, L. S. ROBERTSON (*Engin. Standards Committee Rpt. 76 (1916), pp. 16*).—These specifications and definitions were approved by the British Engineering Standards Committee, supported by five British national engineering societies.

Motor truck lessens cost of maintaining gravel roads in Alabama, T. H. EDWARDS (*Engin. Rec., 74 (1916), No. 3, pp. 73, 74, figs. 6*).—Working data for 650 miles of road are reported which indicate that from 16 to 20 mules may be replaced by a motor truck for pulling a scarifier, and complete scraping after every rain is made possible, the truck drawing three road machines covering 30 miles a day. The cost of hauling gravel was reduced from 30 to 40 cts. to from 7 to 11 cts. per yard-mile and included spreading on the road in addition.

Public road mileage and revenues in the Middle Atlantic States, 1914 (*U. S. Dept. Agr. Bul. 386 (1916), pp. 27, fig. 1*).—This bulletin contains "a compilation showing mileage of improved and unimproved roads; sources and amounts of road revenues; bonds issued and outstanding; and a description of the systems of road administration and fiscal management, and of other factors affecting road improvement in each State."

New tests of bolted joints in timber framing, H. D. DEWELL (*Engin. News, 76 (1916), No. 3, pp. 111–115, figs. 7*).—Tests of 24 bolted joints, 10 all-timber lagscrewed joints, 4 joints in which a steel plate was lagged to timbers with $\frac{3}{4}$-in. and $\frac{7}{8}$-in. lagscrews, and 13 tests made to determine the bearing resistance of a round bolt against the ends and across the fibers of Douglas fir are reported. "The author believes that the following conclusions and recommendations for working data, made from a study of the tests, are justifiable and reasonably conservative:

"For bolts with driving fit in the timbers the strength of the joint is practically independent of the thickness of the side pieces, when this thickness exceeds the limiting value '*t*.' While the ultimate strength of the joints whose bolts have cross-bearing in the main timber is far below that of the all-end-bearing joints, the stiffness of such joints up to the break in the curve is practically the same.

"The same loads for bolts in joints like those described, having all end bearing, may be taken as per [the following]:

"*Working strength of one bolt in timber joint (bolt in double shear) for joints similar to test joints, with bolts bearing against the end of the grain.*

Size of bolt.	Thickness of side pieces and one-half thickness of center timber.			
	2 in.	3 in.	4 in.	6 in.
In.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
$\frac{1}{2}$	1,057	1,275	1,460	1,460
$\frac{3}{4}$	1,450	1,665	1,980	2,100
$\frac{7}{8}$	1,900	2,130	2,450	2,850
1	2,460	2,664	2,960	3,705

"These values correspond fairly well to one-half the loads for $\frac{1}{16}$-in. slip. These working loads are consistent with the results of tests on nailed joints.

"For the allowable pin pressure it is proposed that for Douglas fir and similar timbers 800 lbs. per square inch be used for cross-bearing and 1,300 lbs. per square inch for end bearing.

"For connections in which the bolts are in single shear only, as in the case of two timbers bolted together, it is recommended that the value of the bolts be taken at one-half the values given in [the] table. For connections in which the bolts bear across the fibers of the timber, it is recommended that the values of the bolts be taken at six-tenths the values given for all end bearing.

"The working values recommended are for Douglas fir. For other timbers these values are to be multiplied by the factors following: Long-leaf yellow pine, 1.05; white pine, 0.78; Norway pine, 0.65; white oak, 0.78. All working values herein given are for timber in a dry condition, as for use in the interior of buildings."

Lagscrewed joints in timber, H. D. DEWELL (*Engin. News, 76 (1916), No. 4, pp. 162–164, figs. 5*).—Tests of 14 timber joints fastened by lagscrews, of which 4 were on joints in which a 0.5 in. steel plate was fastened to a timber block and 10 were on joints in which wooden plates 1.25 to 2 in. in thickness were lagged to an 8 by 8 in. block are reported.

"The test results show that (1) for loads up to 2,000 lbs. per screw the strength of a ⅞ in. lag is not appreciably larger than that of a ¾ in. lag; and (2) the working values as given by Kidder correspond to a slip of 0.08 in. for the ¾ in. screw and 0.12 in. for the ⅞ in. lagscrew. . . .

"On comparing the curves of the lagscrewed all-timber joints with those of the bolted joints it is evident that while the ultimate strength of the former is far below that of the latter for the same diameter of lag or bolt, the lagscrewed joints are stiffer for the same load, up to the break in the curve. . . . As in the case of the bolted joints, there seems to be practically no reduction in stiffness for the ⅞ in. joints, in which the lagscrews bore across the fibers of the timber in the main block. This statement holds true only for loads of approximately 2,000 lbs. per lagscrew. In ultimate strength such joints are far below those having all end bearing; the failure is sudden and due to splitting of the main timbers. . . .

"With the criterion of a working strength of one-half the load corresponding to a slip of 1/16 in., the safe resistance of a ¾ by 4½ in. lagscrew may be taken as 900 lbs., while that of a ⅞ by 5 in. lagscrew may be taken at 1,050 lbs. Similarly for a working slip of 1/32 in. the respective resistances are 1,375 lbs. and 1,500 lbs. For joints in which a metal plate is fastened to timbers by means of lagscrews it is believed that the values of 900 lbs. for a ⅞ by 5 in. lagscrew and 770 lbs. for a ¾ by 4½ in. lagscrew are reasonable working values and that 1,300 lbs. and 975 lbs., respectively, should be the maximum allowable capacity used. For all-timber lagscrewed joints similar to those tested the value of 1,050 lbs. for a ⅞ in. lag and 900 lbs. for a ¾ in. lag are recommended for design, with a maximum of 1,500 lbs. and 1,375 lbs., respectively. All working values advocated are for timber in a dry condition and for use in interior building construction."

Rules for conducting performance tests of power plant apparatus (*Amer. Soc. Mech. Engin., Rpt. Power Test Com., Codes of 1915, pp. 215, figs. 27*).—This includes, among other things, sections on the testing of pumping machinery, gas and oil engines, and water wheels.

Directory and specifications of gasoline and oil farm tractors (*Farm Machinery, No. 1293 (1916), pp. 52, 53, 55, 56*).—This list includes 189 tractors of 114 different makes.

A standard drawbar rating for tractors, R. Olney (*Farm Machinery, No. 1291* (*1916*), *pp. 13–15, figs. 2; Power Farming, 25* (*1916*), *No. 8, pp. 9, 50–52, fig. 1*).—In an address before the National Gas Engine Association, the author advocates the rating of tractors on the basis of the actual pounds of pull developed at the drawbar instead of on the horsepower basis and reports experimental data to substantiate his argument. Motor torque and brake horsepower curves, reproduced from the data obtained from an actual prony brake test on a 3½ by 5¼ tractor motor of the 4-cylinder, heavy-duty type, are given showing that the torque and likewise the pounds of drawbar pull remain practically constant throughout a wide range of motor speeds, while the brake horsepower varies directly as the speed up to a certain point.

"A prony brake test should be made on the motor to obtain data for determining the torque and brake horsepower at various speeds. The torque curve of any motor . . . will indicate the normal or critical speed of the motor or the speed at which the motor produces the greatest torque. The brake horsepower rating should be given on the basis of the torque produced at this speed. The basis for the drawbar rating should be the pounds pull exerted in an actual pulling test. The drawbar test should be made with the motor running at its critical speed and with the tractor traveling at its best working speed as fixed by the gear ratio."

Controlled tests of mechanical cultivating apparatus, Ringelmann et al. (*Compt. Rend. Acad. Agr. France, 2* (*1916*), *No. 22, pp. 609–615*).—This is a review and summary of the results of several different trials.

Tobacco-curing barns, E. G. Moss (*N. C. Agr. Ext. Serv. Circ. 18* (*1916*), *pp. 9, figs. 5*).—This circular, prepared under a cooperative agreement between the North Carolina Experiment Station and the U. S. Department of Agriculture, reports an experiment in tobacco curing begun in 1911, the object being to determine where more uniform curing, considering weather conditions and varying amounts of water in the tobacco at the time of curing, can be made and "whether the fuel consumption could not be materially reduced by using tight barns fitted with proper ventilators so placed in the barn as to keep a current of air circulating through the tobacco when needed.

"For this experiment two 18-ft. log barns were used. On one of these the old roof was replaced by a tight cover of galvanized V-crimp iron. Between the sheeting 1-in. strips were nailed to prevent air escaping around the eaves of the roof. The barn was daubed inside and out so as to make it as nearly air-tight as was practical. Seven 4-in. pieces of terra cotta pipe 2 ft. long were placed in the underpinning of the barn, the bell of the pipe being flush with the outside of the barn and extending inside the barn and delivering the air either under or against the sheet-iron pipes used as flues. By this means the air is slightly heated before coming in contact with the tobacco, and consequently more quickly absorbs the moisture from the green tobacco. A type of inverted trough ventilator . . . was placed on top of the barn. . . . The second barn . . . was covered with boards, was well daubed outside, and fitted with the same size furnaces and flues as the tight barn. Each of these barns would hold about 400 sticks of cut tobacco."

It was found that a saving of 2⅜ cords of wood was effected in the tight barn during four curings, which is considered to be a considerable advantage. Plans and a bill of material for a barn of this type are included.

Lightning rods; their functions and good qualities, T. Croft (*Farm Machinery, No. 1293* (*1916*), *pp. 35–37, figs. 8*).—This article deals with the development and effectiveness of lightning rods and with their installation and protection.

RURAL ECONOMICS.

The elements of an ideal rural civilization, H. J. Waters (*Proc. Soc. Prom. Agr. Sci., 36 (1915), pp. 7–15*).—In this address, delivered before the meeting of the Society for the Promotion of Agricultural Science at Berkeley, Cal., in August, 1915, the author summarizes what he considers the elements of an ideal rural civilization as follows:

"Opportunities for the rural people equal to those of the town people and the power and inclination of the rural people to live up to their opportunities, or to phrase it more tersely, income and idealism, are the two elements out of which a stable and satisfactory rural civilization will be built. A society having for its object the promotion of the science of agriculture can not afford to exalt one of these elements above the other."

Some effects of war conditions on agriculture, A. Smetham (*Jour. Roy. Lancashire Agr. Soc., 1916, pp. 25–48*).—Among the effects to which attention is called in this article is the scarcity of commercial fertilizers and commercial feeding stuffs.

Women and the land, Viscountess Wolseley (*London: Chatto & Windus, 1916, pp. XI+230, pls. 12*).—This book discusses the relationship of women to the problems of English agriculture, not only from the viewpoint of present war conditions, but also in relation to future development. Among the topics treated are the peasant class of the future, cooperation, women's institutes, better housing conditions, better farm wages, village industries, the education of farm women and girls, and the women gardeners of the future.

Our country church problems, E. C. Branson (*Univ. N. C., Ext. Bur. Circ. 1 (1916), pp. 10*).—The author discusses the influence of rural migration, farm tenancy, and absentee preachers upon the rural church problem, and advocates the establishment of a country church with home-resident ministers receiving living salaries.

Factors affecting interest rates and other charges on short-time farm loans, C. W. Thompson (*U. S. Dept. Agr. Bul. 409 (1916), pp. 12, pls. 2*).—Among the factors discussed are the natural conditions affecting agriculture, distance from financial centers, character of the borrowers, methods and character of farming, and characteristics of the loan and the relation of the farmer to the loan agency.

Influence of age on the value of dairy cows and farm work horses, J. C. McDowell (*U. S. Dept. Agr. Bul. 413 (1916), pp. 12, figs. 5*).—These estimates are based on information obtained from men who have had wide experience with the class of live stock on which they have furnished information. In order to eliminate everything except age, the animals were assumed to be in perfect health and to have a fixed value at a certain age. The estimates for each breed of dairy cattle were based on four classes of 3-year-olds, namely, the $80-grade cow, the $100-grade cow, the $200 pure-bred cow, and the $300 pure-bred cow. The farm work horse was assumed to have a maximum value of $250 when in his prime.

It was found that for all breeds and for all classes of breeds, the prices of cows in health is greatest between five and seven years with the maximum usually at six years. Cows are valued about the same at four as at eight years. The author's explanation is that although the younger animals have before them a long period of usefulness the older ones have already demonstrated their work. In all the estimates the 14-year-old values for pure-bred cows were much greater than for grades.

The farm work horse seems to reach his maximum value at some point between six and seven years of age. As compared with the values given for pure-

bred dairy cattle of about the same maximum value, the birth value of the horses is considerably less, the age of maturity a little later, and the old-age value somewhat higher.

The normal day's work of farm implements, workmen, and crews in western New York, H. H. Mowry (*U. S. Dept. Agr. Bul. 412 (1916), pp. 16*).—The information made available in this bulletin was obtained by a circular of inquiry from farmers in Wayne, Ontario, Monroe, Genesee, Livingston, Orleans, and Niagara counties, and relates to such farm operations as plowing, harrowing, and rolling and operations in connection with the planting and harvesting of grain crops, the handling of manure, haying, and the care and harvesting of cabbage and fruit crops.

Systems of renting truck farms in southwestern New Jersey, H. A. Turner (*U. S. Dept. Agr. Bul. 411 (1916), pp. 20*).—The farms from which records were secured were in Gloucester, Salem, and Cumberland counties. The farms were subdivided into early and late truck farms and also classified according to the methods of renting. Among the more general conclusions brought out by this study was that the average labor income of 186 farms let for a half share of the crops was $223 for the tenant and 6.8 per cent on the landlord's investment. The average for 35 farms let for cash was $206 for the tenant and 3.7 per cent on the landlord's investment. The bulletin discusses in detail the incomes and system of farming as carried on by the farmers under the various classifications noted above.

The logged-off lands of western Washington, H. F. Giles (*Olympia, Wash.: Bur. Statis. and Immigr., 1915, rev. ed., pp. 64, pl. 1, figs. 16*).—This report contains information regarding the available logged-off lands and methods of clearing and of farming such lands.

The country elevator in the Canadian West, W. C. Clark (*Queen's Quart., 24 (1916), No. 1, pp. 46–68*).—The author describes the development of the elevator systems, difficulties encountered, and the present status.

Transportation of agricultural products in Argentina (*Valor de la Producción Nacional su Transporte Ferroviario—Capacidad de Depósitos Graneros en Estaciones y Puertos. Buenos Aires: Min. Agr. Nac., 1916, 2. ed., pp. 69*).—In this volume is given information regarding the transportation of the different cereals, forest products, and live stock and live stock products over the various railway systems of Argentina.

Marketing perishable farm products, A. B. Adams (*Columbia Univ. Studies Polit. Sci., 72 (1916), No. 3, pp. 180*).—The author has attempted to point out the fundamental forces which underlie the marketing of fruit, vegetables, and dairy and poultry products, and to suggest methods of controlling these forces so that the cost of marketing may be reduced.

He claims that the social burdens incident to the marketing of perishables are due to two main causes—to the inherent characteristics of the goods themselves and to the imperfections in the methods and processes by which they are marketed. Because of the natural perishability of the goods many of them become unfit for consumption before they can be offered to consumers. The natural seasonal production of the goods creates temporary surpluses in the available physical supply which adds greatly to the decay of the goods by lengthening the average time between their harvest and consumption. The burden of marketing them is further increased because they are goods which must be produced by a small business unit (the farm) and consumed by a smaller one (the family).

He further states that "if we are to reduce the social costs of marketing perishables through a reform in the system of marketing, it must be done by

finding cheaper and more efficient ways of performing the complicated processes, not by reducing the number of those processes."

Cooperation for fruit growers, A. F. MASON (*Proc. State Hort. Assoc. Penn., 57 (1916), pp. 52–60, pls. 4*).—Among the methods suggested for improving the methods for the marketing of fruit are standardization of the product through methods of packing and growing, cooperative purchase of supplies, cooperative advertising, centralization of selling and distribution, utilizaton of by-products, and the employment of efficent managers.

Rural cooperation, E. LAHITTE (*La Cooperacion Rural. Buenos Aires: Min. Agr., 1915, 2. ed., pp. 92*).—This book contains a brief description of cooperative organizations as found in Italy, France, Austria, Germany, Argentina, and the United States.

Report of the proceedings of the ninth congress of the International Cooperative Alliance, 1913 (*Rpt. Proc. Cong. Internat. Coop. Alliance, 9 (1913), pp. XLVIII+163, pls. 11*).—Among the topics discussed at this congress, held at Glasgow, August 25–28, 1913, were The Direct Exchange of Goods between Distributive Societies, Agricultural, and other Productive Societies, also between the Wholesale Societies in the Different Countries, by H. Kaufmann; The Closer Relationship and Mutual Help of Cooperative Societies and the Comprehensive Character of the International Cooperative Alliance, by A. Williams; The Development of the Cooperative Press in the Interests of Cooperative Education, by O. Schär; and The Plurality of Distributive Societies Having their Seat in the Same Locality, by L. Buffoli and C. Mellini.

Business practice and accounts for cooperative stores, J. A. BEXELL and W. H. KERR (*U. S. Dept. Agr. Bul. 381 (1916), pp. 56, pl. 1*).—The authors have outlined a simple and adequate system of records for cooperative retail stores and pointed out fundamental business methods that must be observed to insure success. They have discussed this subject under the headings of corporate records, statements and reports, operating records, auditing, and office equipment. The bulletin outlines in detail the necessary records and statements essential to the proper conducting of the store under a cooperative scheme and gives a large number of model forms.

A system of accounts for live-stock shipping associations, J. R. HUMPHREY and W. H. KERR (*U. S. Dept. Agr. Bul. 403 (1916), pp. 14*).—There have been described in this bulletin types of shipping agencies and methods of financing shipping associations, together with methods for keeping the accounts of such associations. The authors have outlined a system in which the only books of record required are a cash journal, consisting of a multi-column cash book and journal combined, with a provision for a detailed account of sales of supplies, and an ordinary form of loose-leaf ledger. They have also described other forms that may be used, such as the shipping record envelopes, members' receipts, members' account sales, manifests, sales tickets, and cash receipts. Sample forms are also included in the bulletin.

Price Current Grain Reporter Yearbook, 1916, E. G. OSMAN (*Price Current Grain Rptr. Yearbook 1916, pp. 88*).—This continues data previously noted (E. S. R., 34, p. 393), giving statistics for later years.

Returns of produce of crops in England and Wales (*Bd. Agr. and Fisheries [London], Agr. Statis., 50 (1915), No. 2, pp. 81–101*).—This continues data previously noted (E. S. R., 33, p. 894), adding statistics for later years.

Agricultural statistics of Argentina, 1914–15 (*Estad. Agr. [Argentina], 1914–15, pp. 186*).—This report continues information previously noted (E. S. R., 35, p. 91), adding data for later years.

[**Agricultural statistics of Sweden**] (*Statis. Årsbok Sverige, 1916, pp. 60–76*).—This continues data previously noted (E. S. R., 33, p. 395), adding statistics for later years.

Agricultural statistics of Roumania (*Min. Agr., Statis. Agr. României, 1915, pp. 35*).—This report contains statistical data showing for 1915 the acreage, average yield, and total production of the principal agricultural crops by Provinces, with comparative data for 1909–1914 for Roumania as a whole.

[**Agriculture in Egypt**] (*Ann. Statis. Egypte, 6 (1914), pp. 319–371; 7 (1915), pp. 107–181*).—This continues data previously noted (E. S. R., 32, p. 894), giving statistics for later years.

AGRICULTURAL EDUCATION.

The Cook County system of rural education, E. J. Tobin (*Ill. Agr., 20 (1916), No. 8, pp. 705, 706*).—The Cook County (Ill.) course in school-home projects is briefly described. The course comprises field and garden, poultry, cow testing, music, sewing and cooking, and business projects.

To provide a close supervision of the work the county is divided into five divisions, each in charge of a country life director whose duty it is to supervise and direct all school-home projects, recreation, and school work in his division. He must see that all pupils over 10 years of age take at least one school-home project as a part of their regular school work. Each director had charge of about 25 schools with a total attendance of 500 pupils in 1915. Additional supervision was found necessary for the summer vacation, and the county provided $2,800, which allowed each country life director $500 for additional supervision of school-home projects in his division. Fifteen "wandering" supervisors were selected for their efficiency in this work by the directors from among their own teachers, so that each pupil's project was visited about once a week.

The author, who is county superintendent, finds this supervision of great value in that it takes the teacher directly into the homes, makes the school a force in the community by linking the pupil's work with the family life and the rural business of the farm, and directs the pupils' energy in a proper way during the summer vacation months. By this method the school period is extended, the rural school is placed on a basis of efficiency, and the parents become interested and willing to cooperate.

The net profits from the school-home project belong to the pupil and must be banked, loaned, or wisely expended. Each pupil is obliged to keep an itemized account of his receipts and expenditures. All pupils who successfully carry through a school-home project are publicly granted an achievement emblem, consisting of a four-pointed star, and year after year silver stars are welded in the emblem as a recognition for completion of further projects. A magazine, *Achievement*, devoted to the interests of pupils carrying on school-home projects, is published annually.

[**Agricultural education in New Brunswick in 1915**], R. P. Steeves, R. Newton, and Hazel E. Winter (*Rpt. Agr. New Brunswick, 1915, pp. 6–24, 91–96, pls. 6*).—Included in this report of the department of agriculture of New Brunswick for 1915 are the reports of the director of elementary agricultural education, the director of agricultural schools, and the supervisor of women's institutes.

Instruction in nature study and agriculture was given to 2,711 pupils (an increase of 1,355 over the previous year) through 48 school gardens, an increase of 16 gardens over the previous year. The number of home plats conducted by pupils under the supervision of teachers increased from 59 to 378.

The success of the first rural science school in the Province for the training of teachers in nature study and elementary agriculture in 1914, at Woodstock, led to the organization of two such schools—at Woodstock and Sussex—during the past summer. The enrollment at these schools was 65 and 115, respectively. The first school fair was held during the year. The work of the agricultural schools at Woodstock and Sussex was limited to short courses of from a few days to 6 weeks in length, but it is planned to develop longer courses as the work progresses. There are now 80 women's institutes with a total membership of 2,400. Their activities included patriotic work, agricultural lectures, exhibits, and short courses.

The General Direction of Agricultural Instruction (*Min. Agr. Argentina, Mem. Cong. Nac., 1913, pp. 67–89*).—Brief reports are given on the work in 1913 of the agricultural education service in Argentina, including 4 technical or special agricultural schools, 11 district practical agricultural schools of which 3 are in process of organization, agricultural extension work by 20 district agronomes, and 7 experiment stations in connection with agricultural schools.

[Agriculture and forestry instruction in Austria] (*Land u. Forstw. Unterrichts. Ztg., 29 (1915), No. 3–4, pp. IV+99–226, figs. 7*).—This number contains (1) special articles as follows: The Reform of the Final Examination at the Intermediate Agricultural Schools, by K. Kolb; Forty-Year Development of the Intermediate Agricultural School at Prerau, Moravia, by J. Adamec; The Four-Year Course at the Francisco-Josephinum, by E. Vital; The Present Status of Instruction in Fishery at the Agricultural and Forestry Schools in Austria, Together with Suggestions for Its Future Organization, by O. Haempel; and The Agricultural Schools and the Care of (War) Invalids, by A. Kastner; (2) a review of progress in 1914–15 of the agricultural and forestry institutions of Austria; (3) a review of agricultural literature; and (4) notes.

Tentative course of study for United States Indian Schools (*U. S. Dept. Int., Off. Indian Aff. [Pub.], 1915, pp. VI+3–293*).—This course, prepared under the direction of the Commissioner of Indian Affairs, has been planned with the vocational aim very clearly and positively dominant, with special emphasis on agriculture and home making. It consists of three divisions, namely, primary (first 3 grades), prevocational (grades 4–6, inclusive), and a vocational 4-year course above the sixth grade. Outlines of the course for each year are followed by a description of the subjects.

Gardening is given in the first 2 grades and the study of plants in the third. The prevocational work includes instruction in gardening, dairying, stock raising, plant production, roads, care of implements, and beautifying home grounds, farm carpentry and blacksmithing, farm engineering, farm masonry, painting and shoeing, and harness repairing. There are given to class instruction 1½ hours per week and 22½ hours to practical application. In the vocational course class instruction is given in agricultural botany, soils and soil fertility, farm and household physics, agricultural chemistry, field crops, plant diseases, insects and insecticides, and rural economics, 20 weeks each; and farm practice in farm implements, horticulture, types and breeds of farm animals, and feeds and feeding, each 40 weeks, with 1½ hours a week of instruction and 22½ hours a week of application.

For the girls instruction is given in the first 3 grades in sewing, lace making, housekeeping, cooking, planning and serving meals, care of cows and milk, butter making, kitchen gardening, and poultry raising. In grades 3 to 6 theoretical and practical instruction is given in home training, including the care of the house, water supply, personal hygiene, housekeepers' responsibilities, motherhood, child welfare, cooking, poultry raising, sewing, laundering,

and nursing. The 4-year vocational course endeavors to train Indian girls to become model housewives, and includes 4 years of theoretical and practical instruction in cooking, sewing, and nursing.

Methods of instruction in agriculture, E. S. SELL (*Bul. State Normal School [Athens, Ga.], 3 (1916), No. 3, pp. 29*).—This bulletin contains 42 lessons for recitation and 34 exercises, each requiring a class period, adapted to the rural and village schools of Georgia, and arranged on a seasonal sequence plan. The work can be given in 2 lessons a week for 9 months or 3 lessons a week for 6 months, and includes a study of general principles underlying plant production, field crops, fertilizers and soils, animal hunbandry, poultry raising, farm implements, and farm communities.

Suggestive outlines for agriculture work in rural and village schools: Potatoes, L. G. ATHERTON (*Normal Teacher [Madison, S. Dak.], 4 (1915), No. 4, pp. 16, figs. 5*).—Outlines are suggested for the use of teachers in rural and village schools in giving theoretical and practical instruction in potato growing.

Practical lessons in tropical agriculture, Books II, III, R. L. CLUTE (*Yonkers, N. Y., and Manila, P. I.: World Book Co., 1916, pp. X+258, pl. 1, figs. 166; VII+251, pl. 1, figs. 120*).—Book II discusses the importance of agriculture, the farm as a place of business and as a home, farm implements and their use, and preventing losses on the farm; continues the study of the principles of agriculture begun in Book I (E. S. R., 33, p. 397); and considers the application of these principles in the growing of field crops important in the Philippines, including rice, coconuts, abaca, sugar, corn, tobacco, other fiber plants, and other farm crops. Studies of the silk industry and of poultry raising are included. Each chapter includes practical exercises.

In Book III, the author discusses some of the more important fodder crops and pasturage, legumes, some minor farm crops, crop rotation, fruits on the farm, forests, the farmer's friends and enemies, weeds, farm animals including the horse, cattle, carabaos, swine, goats, and sheep, and their diseases, farm management, business methods for the farmer, business and legal papers, agricultural fairs and food campaigns, aids for the farmer, and field excursions and home projects. Lists of shade trees and decorative plants and agricultural literature, instructions to homesteaders in the Philippine Islands, and directions for organizing a better farming club are appended. Suggestions to the teacher are included.

Nature study preceding agriculture, A. W. NOLAN (*School News and Pract. Ed., 29 (1916), No. 10, pp. 453–455*).—Suggestions are offered for nature study work in grades 1 to 6, inclusive.

In the author's opinion, nature study should be pre-vocational to agriculture before the seventh grade of the public school. It should be differentiated from technical science both in subject matter and method, and should aim to give a general acquaintance with and an interest in the common things and processes of nature, a training in accurate observation as a means of gaining knowledge direct from nature, and useful knowledge concerning natural objects and processes as they directly affect human life interests. The materials to be studied must be those most common and most interesting from the standpoint of everyday life, and finally nature study must be for the child and not for the adult.

The plant notebook, ANNA B. COMSTOCK (*Ithaca, N. Y.: Comstock Publishing Co., 1915, pp. 126, figs. 37*).—This notebook contains a study of the different parts of a plant, followed by questions and blanks for the description of plants studied by the pupils.

Lessons on tomatoes for rural schools, E. A. MILLER (*U. S. Dept. Agr. Bul. 392 (1916), pp. 18, figs. 5*).—The author outlines 10 lessons in a study of the history, importance, and varieties of tomatoes, and the many phases involved

in growing, harvesting, and marketing the crop. Each lesson includes classroom work, practical exercises, references to literature, and suggestions for correlations with other school work. Directions are given for organizing tomato clubs and preparing community exhibits.

The structure of the common woods of New York and the wood collection, distributed by the College of Forestry, R. P. PRICHARD (*Syracuse Univ. [Pubs.], 15 (1915), No. 3, pp. 31, figs. 4*).—This bulletin, which has been prepared for high school pupils especially, contains a description of the structure of the common woods of the State of New York, followed by a key to the species, together with information concerning the characteristic purpose and uses of the woods contained in a collection of 31 different woods in the form of hand specimens which in size are the same as the ordinary card index card. This collection has been prepared and is distributed by the New York State College of Forestry at Syracuse University for use by teachers and pupils interested in biology, nature study, and forestry.

The boy scout's forest book, R. BLACK (*Ottawa, Canada: The Canadian Forestry Association [1916], pp. 31, figs. 25*).—This book is one of a series which the Canadian Forestry Association will present to the boy scouts of Canada to acquaint them with the economic importance of forest conservation and methods of preventing and fighting forest fires.

The teaching of entomology in public schools, L. A. DEWOLFE (*Proc. Ent. Soc. Nova Scotia, No. 1 (1915), pp. 98, 99*).—The author gives reasons for the teaching of entomology as a nature study topic in the public schools, and suggestions for teaching the subject.

Development in animal husbandry instruction, C. S. PLUMB (*Agr. Student, 22 (1916), No. 9, pp. 612–615, figs. 7*).—The author gives a brief account of how live stock ideas were introduced into the agricultural colleges of Massachusetts, Michigan, Ontario, and Wisconsin. He believes that the first attempt in America to teach animal husbandry subjects in a systematic manner, accompanied by laboratory practice, was made by the Ontario Agricultural College, and that the first distinctive animal husbandry courses in the United States were given in 1890 at the University of Wisconsin by the late Prof. John A. Craig.

Home economics instruction (*Cong. Internat. Enseig. Ménager, 2 (1913), Compt. Rend., pp. 258; Raps. Sects. 1, pp. 115; 2, pp. 111, figs. 2; 3, pp. 73; 4, pp. 319*).—This is a report of the proceedings of the general session and of the meetings of the four sections of the Second International Congress of Home Economics Instruction, held at Ghent, June 15–19, 1913. It includes the papers presented at the section meetings dealing with the following subjects: (1) Home Economics Instruction in the Family and the Elementary School, (2) Home Economics Instruction for Adults or In Connection With Secondary Instruction, (3) The Training of Teachers of Home Economics, and (4) The Progress of Home Economics Instruction in the Different Countries and the Importance of this Instruction from the Individudal, Family, National, and Social Standpoints.

High school food work, what besides manipulation? EMMA CONLEY (*Proc. Cent. Assoc. Sci. and Math. Teachers, 14 (1914), pp. 167–171*).—In this discussion the author holds that the art of simple cookery could and should be attained in the grades, or if not given in the grades, in the first few months of the freshman high-school year; in addition to this, food work should be taken up from the standpoint of its relation to the actual conditions which prevail in 85 per cent of the homes of the country, and the cost, digestibility, and nutritive value of the food prepared should form an important part of the lesson to supplement the practical work and thus give it educational value for high school pupils.

Household management in the high school, Bernice Allen (*Proc. Cent. Assoc. Sci. and Math. Teachers, 14 (1914), pp. 151–154*).—The author gives her experience in teaching household management for the first time to high school girls. The work was centered around the preparation of food and cleaning, keeping in mind their scientific, economic, and civic aspects, and considering the relative values of each of the different household activities. The class met for single periods of 45 minutes every day for one semester.

Teaching of food through preparation of meals, Agnes Wilson (*Proc. Cent. Assoc. Sci. and Math. Teachers, 14 (1914)] pp. 154, 155*).—This paper briefly describes the work of two practical housekeeping centers in the tenement district of Chicago.

High school dietetics, Ada Hillier (*Proc. Cent. Assoc. Sci. and Math. Teachers, 14 (1914), pp. 158–160*).—Suggestions are offered on when and how to teach dietetics in the high school.

First lessons in cooking, Cora B. Miller (*Fort Dodge, Iowa: Supervisor Dom. Sci. and Dom. Art Fort Dodge Pub. Schools [1916], pp. 58, figs. 2*).—This text for elementary schools is arranged in 36 lessons, and comprises a study of the different foods classified on the basis of composition and origin, their economic and food values, and directions for cooking and planning and serving meals. Supplementary lessons, instructions on hygiene, and suggestions for rural school work are appended.

Drafting in dressmaking classes, Agnes K. Hanna (*Proc. Cent. Assoc. Sci. and Math. Teachers, 14 (1914), pp. 161–166*).—The author discusses the value of pattern drafting in general school work and in vocational training in the needle trades, the selection of the drafting system to be used in class work, and the method of presentation. It is found that drafting as an end in itself is "of value only to the highly specialized pattern maker. Its value lies in its ability to offer a comprehensive and effective study of certain principles of line which are fundamental in garment construction, its essential value being the economy of effort which this study should secure in comparison with the more empirical method of experimentation."

Teaching house decoration in the high school, Isabel Clark (*Proc. Cent. Assoc. Sci. and Math. Teachers, 14 (1914), pp. 156–158*).—A brief account is given of how a course in house decoration was presented in one period a week to the sophomore girls in the domestic art class at the high school in Oshkosh, Wis.

Woodworking problems, S. T. Newton (*Manitoba Agr. Col. Bul. 20 (1916), pp. 69, figs. 32*).—These problems for members of boys' and girls' club contests have been prepared to teach them how to handle the ordinary carpenter's tools and how to read working drawings. Projects have been chosen that are useful around the farm home, including a poultry fattening crate, milking stool, farm gate, etc.

MISCELLANEOUS.

Annual Report of Florida Station, 1915 (*Florida Sta. Rpt. 1915, pp. CXXXI+XI, figs. 14*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1915, a list of the publications of the year, a general review of the work of the station during the year, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue. Analyses of Japanese cane are also included.

Report of the Guam Agricultural Experiment Station, 1915 (*Guam Sta. Rpt. 1915, pp. 43, pls. 7, figs. 4*).—This contains reports of the agronomist in charge and the animal husbandman and veterinarian, and apicultural notes.

The experimental work recorded is for the most part abstracted elsewhere in this issue.

Work and progress of the agricultural experiment station for the year ended June 30, 1915 (*Missouri Sta. Bul. 141 (1916), pp. 58, figs. 10*).—This contains the organization list, a report of the director on the work and publications of the station, and the work of the college-extension service, and a financial statement for the station as to its Federal funds for the fiscal year ended June 30, 1915. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Fourteenth Annual Report of the Wisconsin Agricultural Experiment Association, 1916 (*Ann. Rpt. Wis. Agr. Expt. Assoc., 14 (1916), pp. X+124, pls. 11*).—This report contains addresses and discussions at the annual meeting, including a report on the association's cooperative experimental work, and other data.

Monthly Bulletin of the Ohio Experiment Station (*Mo. Bul. Ohio Sta., 1 (1916), No. 8, pp. 225–256, figs. 6*).—This contains several articles abstracted elsewhere in this issue; Wheat Experiments, by C. G. Williams, an abridgement of Bulletin 298 (E. S. R., 35, p. 534); and the following special articles: County Cooperation to Control Hessian Fly, by H. A. Gossard and G. R. Eastwood; Cockroaches and Their Control, by V. R. Haber; Potato Exhibits, by S. N. Green; Handling the Weed Situation, by A. D. Selby; Classification of Soils in a Soil Survey, by W. C. Boardman; and Low-Grade, Ready-mixed Fertilizers, by C. E. Thorne.

A note book of agricultural facts and figures, compiled by R. C. Wood et al. (*Madras: Agr. Col. Coimbatore, 1916, 2. ed., pp. 188, pl. 1, figs. 22*).—This handbook has been prepared with special reference to use in South India, and contains much information regarding weights and measures, buildings and roads, machinery, soils, manures, crops, foods and feeding, live stock, agricultural labor, insect pests, horticulture, forestry, statistical data, etc., of the region.

Masonry bases for the installation of microscopes and their accessories, including the camera lucida and the microscopic camera, N. A. Cobb (*Trans. Amer. Micros. Soc., 35 (1916), No. 1, pp. 7–22, pls. 4, fig. 1*).

NOTES.

Illinois University and Station.—The resignations are noted of Clarence C. Logan, assistant in soil extension; Ward H. Sachs, associate in chemistry; Clyde R. Newell, instructor in farm mechanics; and F. C. Richey, assistant in soil physics. E. A. White has returned from a two years' leave of absence at Cornell University and resumed his duties as assistant professor in farm mechanics.

Purdue University and Station.—The new biology building is under construction and is expected to be ready for occupancy in March, 1917.

J. D. Luckett, assistant chemist in the station, has accepted an appointment on the staff of *Experiment Station Record* in the section of field crops and has entered upon his duties.

Iowa College and Station.—A new dairy barn, designed as a model as to arrangement and construction, is being erected on the college dairy farm.

A total of 3,181 requests for blueprint plans for self-feeders were received at the station from October, 1915, to June, 1916.

New projects begun by the station include studies of the specific nutritional effects of rations upon swine and sheep, the feeding of rape silage to swine, the water requirements of dairy cows when on succulent feeds, and the digestibility of Sudan grass.

Arthur S. Thurston has been appointed assistant professor of floriculture and truck crops. L. S. Gillette, assistant professor of dairy husbandry in the college, has been appointed assistant chief in dairy husbandry in the station.

Minnesota Station.—A two-story institute hall has been completed at the Duluth substation. The first floor contains an auditorium and office space, and the second, dormitory accommodations, a kitchen, and a dining room. The new equipment will make possible the holding of community gatherings at the substation, as well as afford a meeting place for various farm organizations of northeastern Minnesota.

Missouri Station.—The department of animal husbandry has been authorized to spend a balance of $2,000, remaining from its biennial appropriation, in the purchase of pure-bred live stock.

Charles G. Carpenter has been appointed assistant in horticulture and John B. Smith assistant in farm crops.

New Hampshire College and Station.—Dr. Charles H. Otis has resigned as instructor and assistant botanist to accept a position in the biological laboratory of Western Reserve University.

New Jersey Stations.—D. Manley Jobbins, for a number of years florist and in charge of the greenhouses, died November 11.

Ohio State University.—The new home economics building is approaching completion. It is a three-story brick building, costing about $150,000, and containing, among other features, a textile laboratory, a large room for work in instructional management, an experimental flat for courses in house decoration and household management, quarters for the extension department, and an auditorium seating about 500 people.

West Virginia University.—Dr. C. H. Winkler has been appointed professor of rural education, vice M. J. Abbey, resigned.

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U. S. DEPARTMENT OF AGRICULTURE

STATES RELATIONS SERVICE

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Vol. 35 INDEX NUMBER

EXPERIMENT STATION RECORD

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[1] Director. [2] Agronomist in charge. [3] Animal husbandman in charge. [4] Acting director.

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Note.—The abbreviations "Ala. College," "Conn. State," "Mass.," etc., after entries refer to the publications of the respective state experiment stations; "Alaska," "Guam," "Hawaii," and "P. R." to those of the experiment stations in Alaska, Guam, Hawaii, and Porto Rico; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

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